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2009

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Abstract

This paper presents numerical measures of European consumers' inflation expectations derived on the basis of European Commission qualitative survey data with different quantification methods, i.e. with the probability method, the regression method and the logistic (and linear) function method. The study aims at assessing differences between those measures and the resulting uncertainty in measuring inflation expectations of this group of economic agents. Moreover, in the empirical part of the paper the formation of expectations by consumers in European economies is examined, with a particular focus on estimating the degree of forward-lookingness of expectations.

JEL: C42, D12, D84
Keywords: Inflation Expectations, Consumers, Survey, EU

[1] The author wishes to thank the participants of the seminar organized by the Monetary and Economic Department, Bank for International Settlements in Basel, Switzerland (March 25th, 2009) and the participants of the Invited Paper Meeting on *"Quantification of qualitative data from surveys"* during the 57th Session of the International Statistical Institute in Durban, South Africa (August 17th, 2009) for discussions and helpful comments. Opinions expressed in this paper are those of the author and do not necessarily represent the views of the National Bank of Poland.

1. Survey data and quantification methods applied

A straightforward method to measure 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 direction of price changes (Jonung, 1986) and the empirical evidence of 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 included in the European Commission Consumer Survey carried out every month in EU economies has 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 the paper uses two kinds of measures of inflation perception and expectations based on survey data, i.e. 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.

Quantifying probability measures of inflation expectations we refer to the canonical Carlson and Parkin (1975) approach modified in order to use all 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 quantified on the basis of additional survey question (see: Batchelor and Orr, 1988; Dias, Duarte and Rua, 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 statistical properties of the estimated regressions as well as their economic interpretation (e.g. correct signs of the estimated coefficients).

Balance statistics are defined as the differences between (weighted or unweighted) proportions of respondents. They do not measure perceived or expected inflation directly (e.g. Dias, Duarte, Rua 2007), but at the same time they are not influenced by the assumptions imposed in quantification

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

algorithms. Four different balance statistics are used. The first two are unweighted statistics: BS_1^e (BS_1^p) is the difference between proportions of respondents expecting (noticing) an increase in prices and their decrease, while BS_2^e (BS_2^p) is the difference between 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 (e.g. Del Giovane, Sabbatini, 2004, 2005; ECB, 2002, 2003, 2005, 2007), attaching weight 1 to the proportion of respondents expecting that the prices will rise faster than at present (perceiving that the prices now are much higher than twelve 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) stabilisation of prices and -1 to those declaring that they 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 the following: 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 (e.g. 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 limit 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, i.e. the mode (d_t) equals:

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

where:

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

In probability methods 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 time-varying sensitivity interval surrounding 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 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} – percentage of respondents expecting prices to rise faster; a_{2t} – percentage of respondents expecting prices to rise at the same rate; a_{3t} – percentage of respondents expecting prices to rise more slowly; b_t – percentage of respondents expecting prices to stay at their present level; c_t – percentage of respondents expecting prices to go down.

[Figure 1 here]

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:

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

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

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

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

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 here]

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

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

3. Balance statistics and quantification results

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

[Table 2 here]
[Table 3 here]

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 twelve months before; balance statistic BS_1^p equals approximately 79 percentage points, while BS_2^p – 64 percentage points. Both of them reach their maximum values in Spain (96 and 94 percentage points respectively) and minimum values in Denmark (34 and -19 percentage points respectively). Balance statistics capturing different degrees of price increase noticed by respondents, i.e. 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 the future changes in the price level are generally better than survey responses to the question on the perceived price changes: the difference between fraction of respondents expecting price increase and decrease, i.e. balance statistic BS_1^e, amounts to 70 percentage points on average, while the difference between a fraction of respondents declaring expectations of price increase on the one hand, and their stabilization or decrease on the other, i.e. balance statistic BS_2^e, equals 51 percentage points approximately. Weighted balance statistics of inflation expectations BS_3^e and BS_4^e, equal 0.27 and 1.47 respectively, are also lower than their counterparts measuring opinions on perceived price changes (BS_3^p equal 0.31; BS_3^p equal 1.59). All the balance statistics show that Italian consumers reveal the highest degree of optimism assessing future price changes, while Hungarian consumers are the most pessimistic.

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 – only for some of them (see Annex B presenting estimation results of the regression models applied). Figure 1 presents averages of available measures of inflation expectations and current inflation for the common sample period and full individual samples (see Annex C presenting graphs with detailed quantification results).

[Figure 2 here]

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

[Table 4 here]
[Table 5 here]

When summarizing the 2002-2007 results the following points should be made: Firstly, regression measures seem quite different from the remaining ones. The difference between the extreme estimates of inflation expectations equals 1.1 pp on average for all the measures and 0.9 pp for probability and logistic function measures, which corresponds, to 48.4% and 34.6% of their average respectively. Secondly, taking into consideration relative wedge between probability and logistic function measures, it appears that uncertainty in measuring consumer expectations is relatively low in EMU as a whole and its member economies (Luxembourg, France, Spain, Portugal, Austria, Germany), whereas it is relatively high in Denmark, Czech Republic, Malta, Sweden, United Kingdom, Poland and Lithuania. The relative wedge between analyzed measures of inflation expectations is positively correlated with the relative gap between perceived current inflation quantified on the basis of survey data and its statistical measure and with the volatility of the parameter y, i.e. the difference between current inflation and its 12-month moving average (Figure 3). Thirdly, all the measures of consumer inflation expectations are highly correlated with each other, which suggests that even in economies where measurement uncertainty is elevated all the proxies follow similar tendencies.

4. Are European consumers forward-looking?

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

Before presenting the results of 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, affecting also the assessment of expectations' forward-lookingness. It 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 different distribution of responses to the survey question. Then the responses of expectations' measures *INFE_1*, *INFE_2*, *INFE_3* and *INFE_4* were checked. The results obtained (Table 6, Figure 4) show, in general terms, that all the measures change after a change in the current rate of inflation with the magnitude of the reaction dependant on the survey responses.

[Table 6 here]
[Figure 4 here]

To address the risk that the degree of forward-lookingness estimated on the basis of quantified measures of inflation expectations may be biased downwards, balance statistics are used in addition 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 formation of consumer inflation expectations in European economies indicate that backward-looking mechanisms are relatively more important than the forward-looking ones. Gerberding (2001) verifies the model of consumer inflation expectations' formation in Germany, France and Italy showing that expectations are neither purely forward-looking nor purely adaptive, although the relative weight of adaptive mechanism is in all cases greater than one half. Forsells and Kenny (2004) show that consumer inflation expectations in the euro area are characterized by 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 run. Döpke et al. (2006) estimate the 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 use mainly past inflation, but there is also a role for professional forecasts available, which are interpreted as a forward-looking variable. It is found that European households adjust sluggishly to new information, similarly as shown by Forsells and Kenny (2004).

In order to assess the formation of European consumers' inflation expectations on the basis of survey measures described above, in the present paper two types of equations are estimated. 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:

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

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 a_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 a_2 is insignificantly different from zero, inflation expectations are adaptive, i.e. they depend on their lag adjusted for previous expectations' errors (i.e. difference between current inflation[4] and expectations formed with respect to it a year before). Moreover, the specification takes into account a possible impact of a change in the current inflation on inflation expectations.

Alternative version of the test equation (22) – similarly as equation (21) – has a hybrid nature, capturing both forward-looking and backward-looking determinants of inflation expectations. However the static mechanism is applied in its backward-looking part, in which expectations depend on the currently observed inflation:

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

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. In the case 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 average weight of 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 expectations as well as a description of the estimation technique applied. The results are presented both for the common sample period and for individual sample periods.

[
Figure 5 here]
[Table 7 here]

Estimation results show a little importance of forward-looking mechanisms in consumer inflation expectations' formation in Europe, which seems consistent with the results of other studies (e.g. Gerberding, 2001). Average weight of forward-looking factors is lower than 10% both in the

[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 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).

common sample period and in individual sample periods. Taking into consideration years 2002-2007 the highest fraction of consumers forms expectations rationally in Italy (approx. 40%), the Netherlands (approx. 35%) and in the UK (approx. 27%). Positive weight of forward-looking behaviour is also observed in Ireland and Latvia (approx. 25%), in the euro area, Finland, Czech Republic and Poland (approx. 15%), as well as in Denmark, Austria, Bulgaria, Belgium, Slovakia, Cyprus, Sweden and Lithuania. 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 it may be noticed that the weight of forward- vs. backward-looking behaviour varies in time. For example, Italian consumers, whose expectations are characterized 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: in the euro area, Belgium and in the UK. It suggests that there was an increase in forward-lookingness of inflation expectations formed by consumers, which confirms the results of other studies (e.g. Forsells and Kenny, 2004). However, there was a concurrent increase in backward-lookingness of consumer expectations in some economies, i.e. in France, Spain and Portugal.

To compare the results obtained with consumer inflation expectations measures developed in this paper with Gerberding (2001) assessment of forward-lookingness of consumer inflation expectations in France and Italy in 1991-1999, based on 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 (2001) it amounts to 0.30 and 1.00 respectively, while calculations with the use of 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 on past price changes on the survey views on future price changes may be treated as another proxy for the degree of inflation expectations' backward-lookingness. Such approach allows avoiding 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 correlation coefficients for all the pairs of balance statistics of perceived and expected inflation, while Table 8 provides detailed results of calculations.

[Figure 6 here]
[Table 8 here]

[5] As far as the backward-looking component of inflation expectations is concerned, its adaptive form is more frequent than the static one. In a number of cases, in which static version of the test equation was finally chosen, its adaptive version's estimation results were satisfactory as well, but characterized 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 quantified measures of inflation expectations used in this study start in 1992.

Taking into account the average correlations it occurs that in a vast majority of countries under consideration the correlation of consumer opinions about past and future inflation is positive. In contradiction to the assessment based on quantified measures of inflation expectations, being approximately the same in the common sample period (2002-2007) and in individual sample period, the average correlation of balance statistics is significantly higher in the former period (0.53) than in the latter one (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). Comparing the results for the common sample and individual samples there is another interesting observation concerning signs of the correlation coefficient. Considering individual sample periods correlation coefficients in all the economies are positive, while in years 2002-2007 consumer opinions concerning past and future price movements are correlated negatively in the Netherlands, the euro area as a whole, Ireland, Spain, Italy, Austria and Greece (although only in the case of the Netherlands and the euro area statistically lower than zero with 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 price increase as a homogenous group independently of the fact how big increase in prices they declare. Focusing attention on the balance statistics BS_3 and BS_4, it may be observed that in both common sample period and individual sample periods the correlation of consumer subjective opinions on price changes perceived and expected reach its lowest (negative) levels in the Netherlands, while the highest – in Bulgaria. Moreover, in many of the old EU member states and the euro area as a whole, the impact of changes in perception of past price movements on consumer foresights is significantly weaker in 2002-2007 than in individual samples.

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 Economic and Monetary Union there was a jump fall of 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 here]

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

[Figure 8 here]

The highest impact of the euro introduction on consumer inflation perception was noted in the Netherlands and in Germany, the lowest – 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 the

[7] See: Łyziak (2009), pp. 101-102.

[8] Balance statistics BS_3 and BS_4 have a relatively higher weight due to their richer information content. Assessment of the persistence of the euro effect on consumer perception of price changes relies on two indicators, i.e. a difference

highest in Germany and the 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, i.e. before the launch of the euro. It should be noted, however, than the persistence of inflation perception gap seems sizably smaller while using quantified measures of inflation perception instead of balance statistics (Figure 9).[9]

[Figure 9 here]

The impact of the euro introduction on consumer inflation perception is widely discussed in the literature[10], while there is almost no discussion on its impact on inflation expectations. Despite increased inflation perception, expectations that the euro will contribute to price stability were very strong even before the euro introduction. The EOS Gallup Europe survey data (Eurobarometer) show that in 2000-2002 the percentage of individuals in the euro area sharing such opinion was high and rising – from approximately 46% in 2000 to more than 60% in 2002 (Figure 10). In November 2001, i.e. two months before introducing the euro banknotes and coins, consumers in Ireland and Belgium were the most convinced that the euro would contribute to price stability, while relatively low percentages of individuals shared this view in Germany, Finland and the Netherlands. After the launch of the euro, consumers in many of the EMU economies became more optimistic about the future price changes. For example, balance statistics of price expectations by the Dutch consumers – whose perception of price changes was affected by the launch of the common currency in the highest magnitude – decreased in 2002 to the highest extent among euro zone economies. An improvement in price changes 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 Spain and Portugal. As far as long-term effects are concerned, a decrease of balance statistics of inflation expectations in years 2002-2006 was the most substantial in Italy and the Netherlands.

[Figure 10 here]

between the average level of a given balance statistics in years 2002-2006 and in 2001 and a difference between the average level of a given balance statistics in 2006 and in 2001.

[9] E.g. Dias, Duarte, Rua (2007).

[10] There are different explanations of the inflation perception gap after the euro introduction. Many studies point out to a sizeable increase in prices of frequently bought products and services (e.g. Dziuda and Mastrobuoni, 2006; Álvarez González et al., 2004; Fluch, Stix, 2006; ECB, 2003) and the discussion on that effect in the mass media (Del Giovane, Sabbatini 2004, 2005). There are also some psychological factors to be considered, such as: recalculating the prices to former domestic currencies and rounding effects; price increases being perceived by consumers more strongly than price reductions (Fluch, Stix, 2005; Kurri, 2006), or the effect of expectancy confirmation in spite of the disconfirming evidence (Stix, 2006).

Conclusions

The study develops different measures of European consumer inflation expectations quantified on the basis of qualitative survey data with different quantification schemes, i.e. with the probability method, the regression method and the logistic (and linear) function method. Then it assesses differences between those measures and tests the formation process of consumer expectations.

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 consumers' inflation expectations is concerned, the results of empirical tests – conducted both with quantified measures of inflation expectations and balance statistics – show in general that the weight of forward-looking mechanism is rather small, although in some euro area economies and the euro area as a whole an increase in expectations' forward-lookingness may be observed after the introduction of the common currency. Analysis of the detailed results is, to some extent, dependent on the method chosen. From individual countries' perspective, the results based on estimation of the weight of backward- vs. forward-looking mechanism in the formation of expectations does not fully correspond to the assessment based on correlation of 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 simultaneous increase in the weight of backward-looking mechanism in inflation expectations formation estimated on the basis of probability measures of expectations (Table 9).

[Figure 11 here]
[Table 9 here]

Therefore, 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; consumers in Ireland, Spain, Italy, Austria, Greece and the Czech Republic form inflation expectations in a slightly more backward-looking manner; there is a medium-level of backward-lookingness of inflation expectations of consumers in Germany, United Kingdom, Slovenia, Luxembourg, France, Cyprus, Estonia, Poland, Hungary, Finland, Portugal, Malta, Latvia and Belgium and a high importance of backward-looking component in consumer inflation expectations in Sweden, Bulgaria, Denmark, Romania, Lithuania and Slovakia.

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Figures and Tables

Figure 1. Triangular distribution probability quantification method

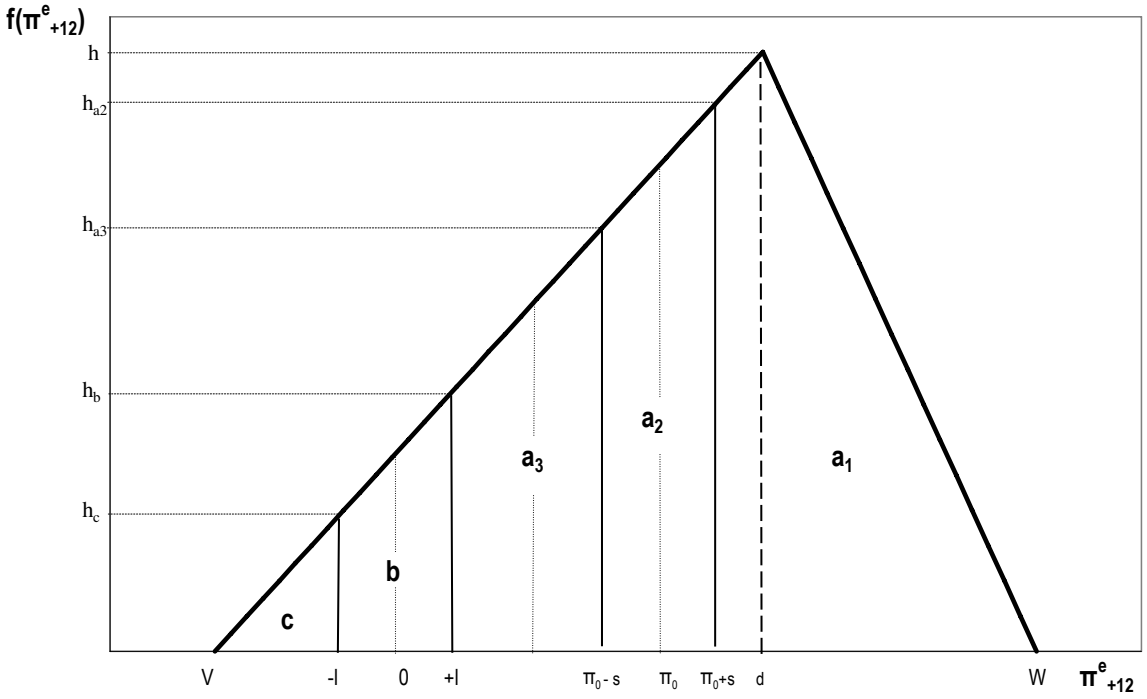


Table 1. Quantification results for the mode located in other parts of the distribution

d_t	Equation	Results for a given location of d_t
$\pi_{0t}-s_t \le d_t < \pi_{0t}+s_t$	(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	$\rho_{2t}=\sqrt{\gamma_t\cdot(1-c_t)}$, $\lambda_{4t}=\dfrac{2\cdot(\rho_{1t}+\rho_{2t})}{\rho_{1t}+\rho_{2t}-2}-\dfrac{2}{\rho_{1t}+\rho_{2t}-2}\cdot\left[\sqrt{\gamma_t a_{1t}}+\sqrt{\gamma_t(a_{1t}+a_{2t})}\right]$

Table 2. Balance statistics of inflation perception (period averages)

	Start of the sample	common sample (11.2002-05.2007)				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 Rep.	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
UK	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: own calculations based on EC data.

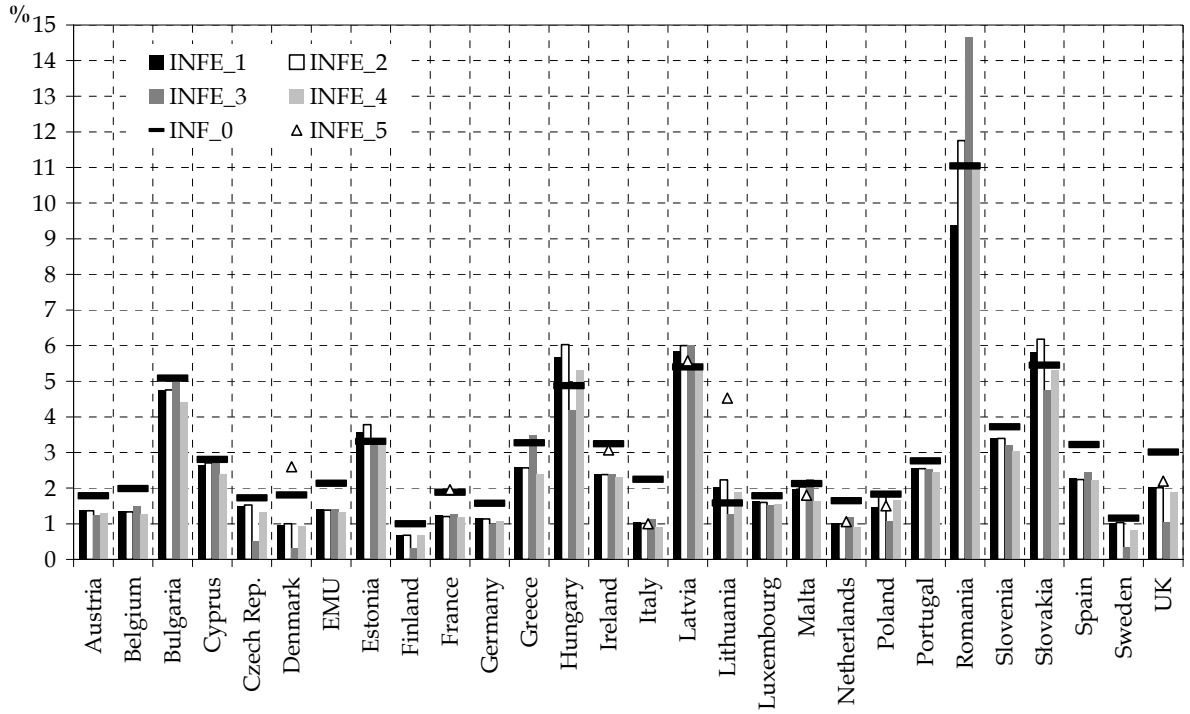
Table 3. Balance statistics of inflation expectations (period averages)

	Start of the sample	common sample (11.2002-05.2007)				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 Rep.	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
UK	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***

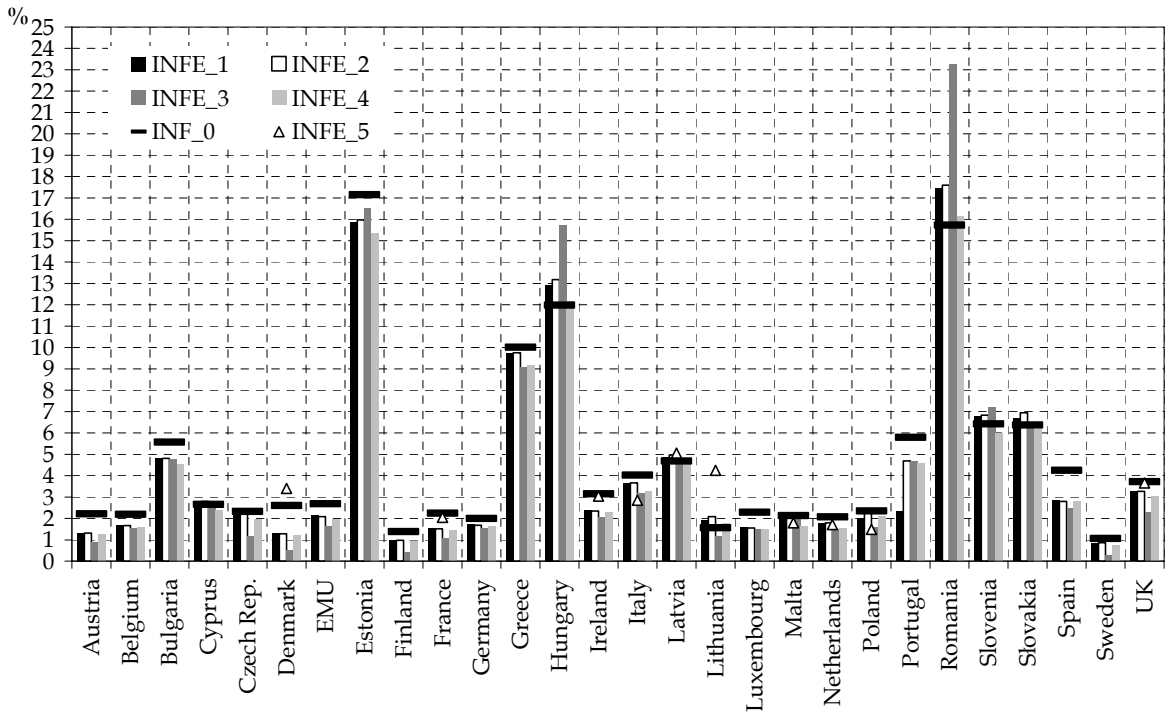
Source: own calculations based on EC data.

Figure 2. Averages of current inflation (*INF_0*) and different measures of inflation expectations[1]

2.A. Common sample (2002.11-2007.05):



2.B. Full individual sample[2]:



[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: own calculations based on EC and IFS data.

Table 4. Differences between inflation expectations' measures, common sample

	Data availability		Wedge (in p.p.), *INFE_i*, *i*=1, 2, 3, 4				average correlation: *INFE_i*, 1<*i*<5 with *INFE_1*	Wedge (in p.p.), *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 Rep.	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***

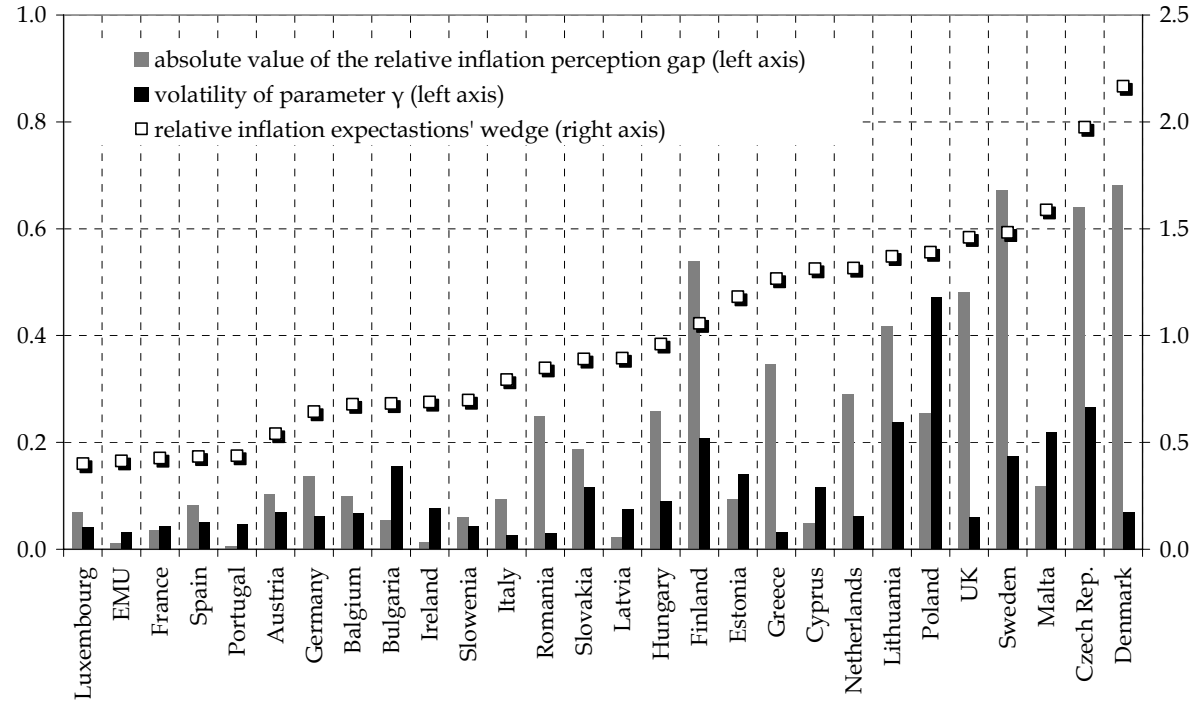
Source: own calculations based on EC and IFS data.

Table 5. Differences between inflation expectations' measures, full individual sample

	Start of the sample	Data availability		Wedge (in p.p.), *INFE_i*, *i*=1, 2, 3, 4				average correlation: *INFE_i*, 1<*i*<5 with *INFE_1*	Wedge (in p.p.), *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 Rep.	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
UK	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: own calculations based on EC and IFS data.

Figure 3. Factors affecting relative wedge between probability and logistic function measures of inflation expectations



Source: own calculations based on EC and IFS data.

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*)

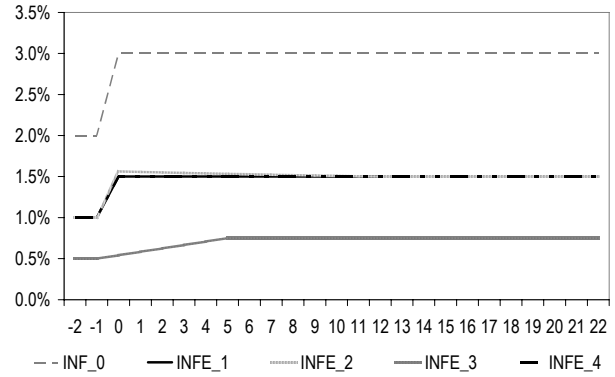
		change in *INF_0* (in p.p.)	response (in p.p.)			
			INFE_1	*INFE_2*	*INFE_3*	*INFE_4*
Case I	maximum response [lag]	1 [0]	0.50 [0]	0.56 [0]	0.25 [12]	0.50 [0]
	response in the long-run	1	0.50	0.50	0.25	0.50
Case II	maximum response [lag]	1 [0]	0.50 [0]	0.56 [0]	0.55 [12]	0.50 [0]
	response in the long-run	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-run	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-run	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.

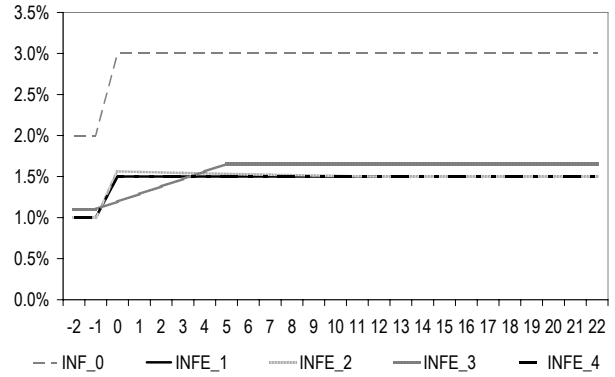
Source: own calculations.

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*)

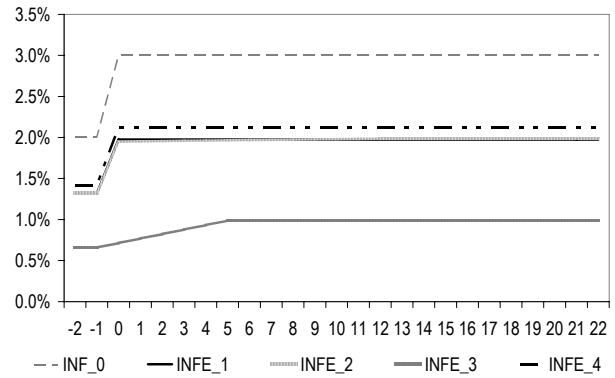
Case I



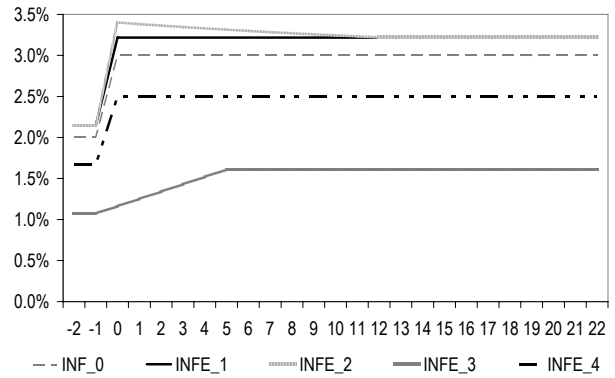
Case II



Case III



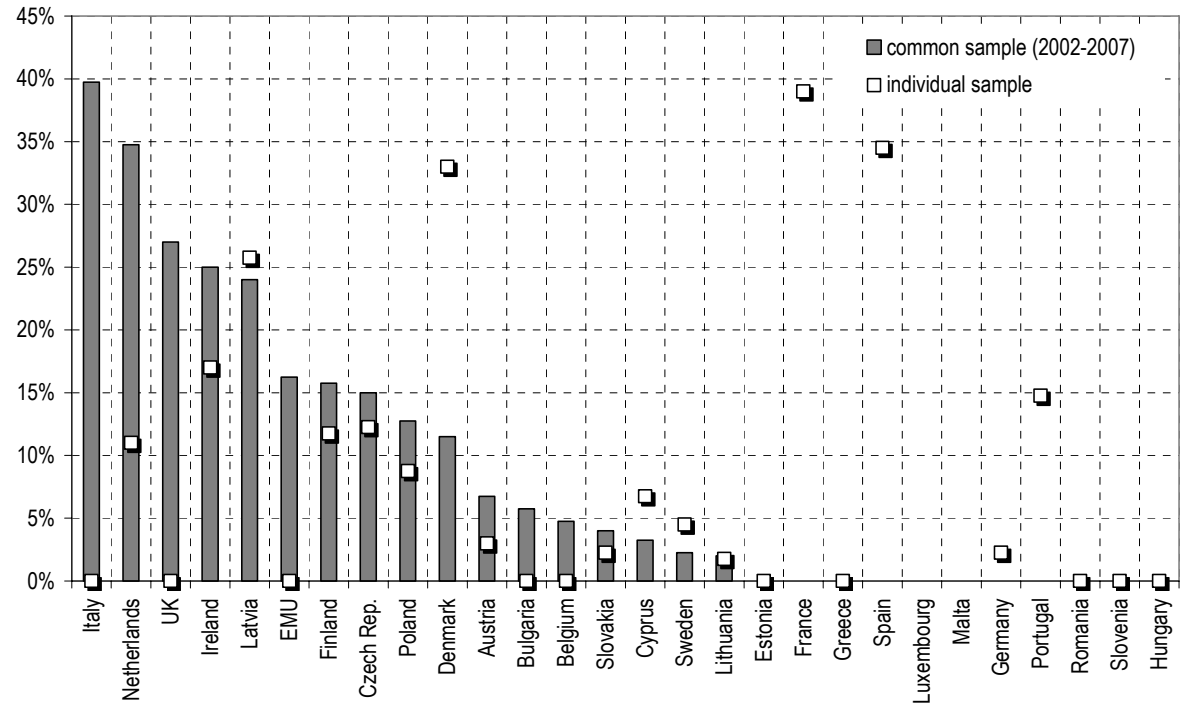
Case IV



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: own calculations.

Figure 5. The weight of forward-looking mechanism in the formation of consumer inflation expectations (average for all measures under consideration)



Source: own calculations based on the results presented in Table 7.

Table 7. Formation of inflation expectations – estimation results[1] of the equations (21) and (22)

	Start of the individual sample	common sample (11.2002-05.2007)					individual sample				
		expectations' measure, equation version[2], R^2_{adj}	weight of forward-lookingness, a_2	weight of backward-lookingness $(1- a_2)$	a_3	a_4	expectations' measure, equation version[2], R^2_{adj}	weight of forward-lookingness, a_2	weight of backward-lookingness $(1- a_2)$	a_3	a_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 Rep.	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 (11.2002-05.2007)					individual sample				
		expectations' measure, equation version(2), R^2_{adj}	weight of forward-lookingness, a_2	weight of backward-lookingness $(1-a_2)$	a_3	a_4	expectations' measure, equation version(2), R^2_{adj}	weight of forward-lookingness, a_2	weight of backward-lookingness $(1-a_2)$	a_3	a_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 (11.2002-05.2007)					individual sample				
		expectations' measure, equation version(2), R^2_{adj}	weight of forward-lookingness, a_2	weight of backward-lookingness $(1 - a_2)$	a_3	a_4	expectations' measure, equation version(2), R^2_{adj}	weight of forward-lookingness, a_2	weight of backward-lookingness $(1 - a_2)$	a_3	a_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 (11.2002-05.2007)					individual sample				
		expectations' measure, equation version(2), R^2_{adj}	weight of forward-lookingness, a_2	weight of backward-lookingness ($1-a_2$)	a_3	a_4	expectations' measure, equation version(2), R^2_{adj}	weight of forward-lookingness, a_2	weight of backward-lookingness ($1-a_2$)	a_3	a_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)	-

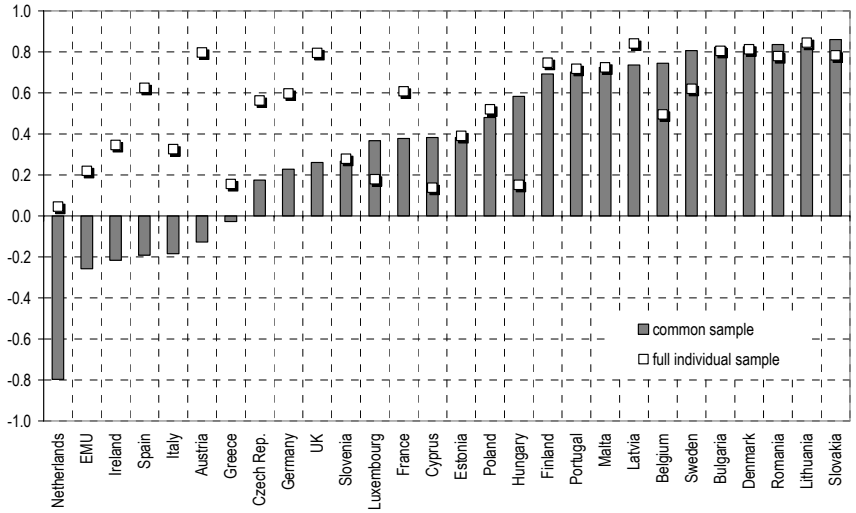
	Start of the individual sample	common sample (11.2002-05.2007)					individual sample				
		expectations' measure, equation version[2], R^2_{adj}	weight of forward-lookingness, a_2	weight of backward-lookingness ($1-a_2$)	a_3	a_4	expectations' measure, equation version[2], R^2_{adj}	weight of forward-lookingness, a_2	weight of backward-lookingness ($1-a_2$)	a_3	a_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)	-
UK	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)	-

[1] Estimation technique: Following the usual way, 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 two-stage least squares method (2SLS) is used to estimate both versions of the test equation with constant and twelve lags of current inflation being the instruments (in line with Gerberding 2001).

[2] "A" denotes that the estimated equation is consistent with the specification (21), while "S" denotes the alternative version of the test equation (22). Symbol "*" denotes the use of a constant in the estimated equation.

Source: own calculations.

Figure 6. Correlation of balance statistics of perceived and expected inflation (average for all the pairs of balance statistics)



Source: own calculations.

Table 8. Correlation of balance statistics of perceived and expected inflation

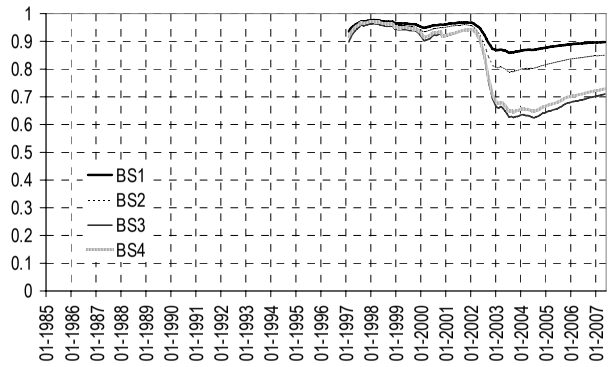
	Start of the individual sample	common sample (11.2002-05.2007)				full individual sample			
		BS_1	BS_2	BS_3	BS_4	BS_1	BS_2	BS_3	BS_4
Austria	01.1985	-0.04(n)	-0.09(n)	-0.19(n)	-0.19(n)	0.90	0.85	0.71	0.73
Belgium	01.1985	0.65	0.71	0.81	0.81	0.53	0.54	0.46	0.45
Bulgaria	05.2001	0.79	0.84	0.84	0.82	0.73	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 Rep.	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
UK	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*

Symbol (n) denotes correlation coefficients not significant with 10% significance level.

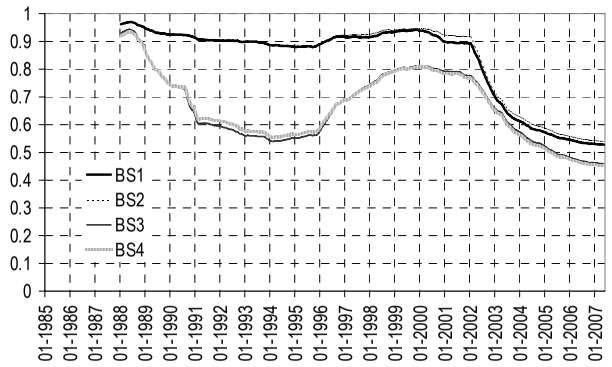
Source: own calculations based on EC survey data.

Figure 7. Dynamic correlations of balance statistics of perceived and expected inflation

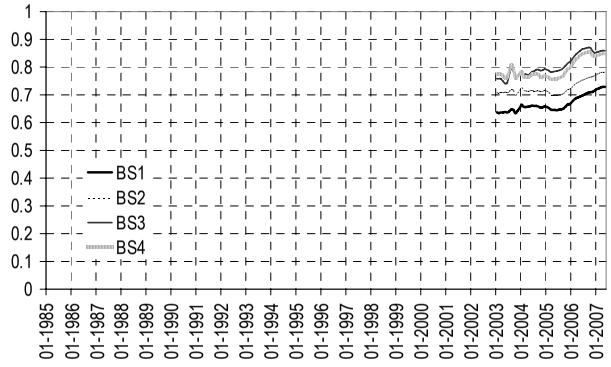
Austria



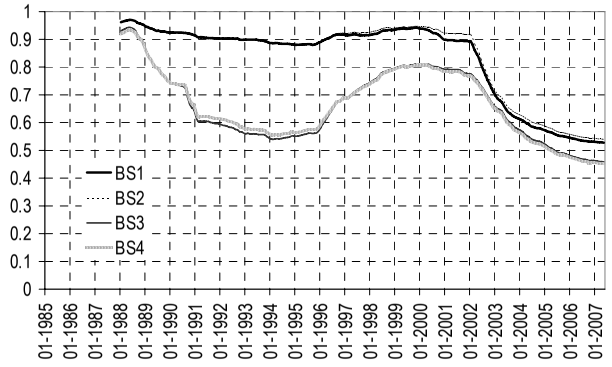
Belgium



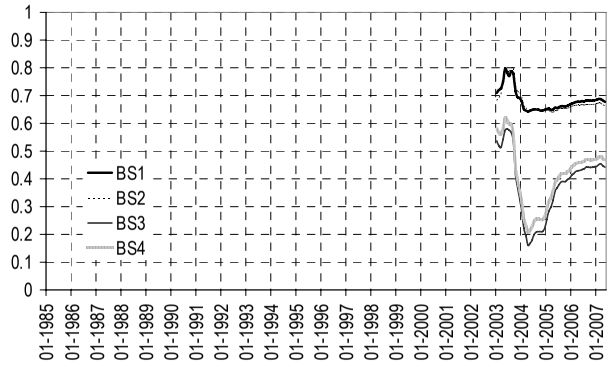
Bulgaria



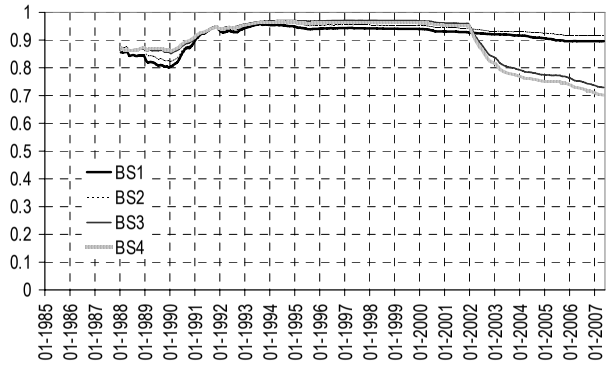
Cyprus



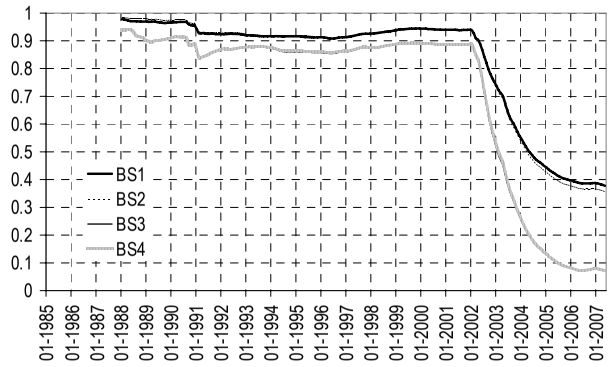
Czech Rep.



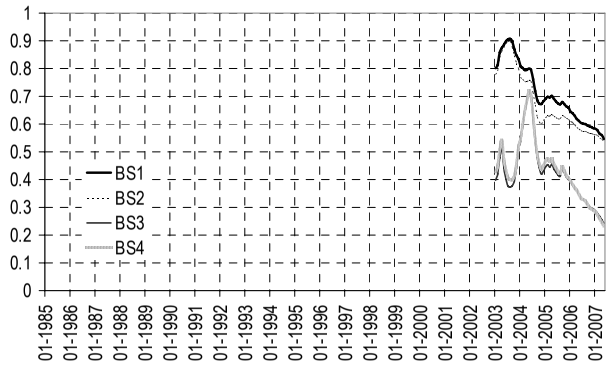
Denmark



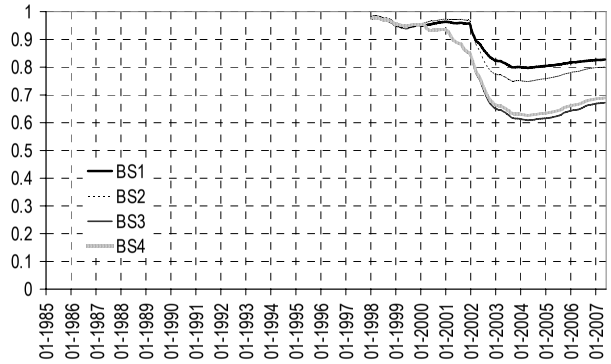
EMU



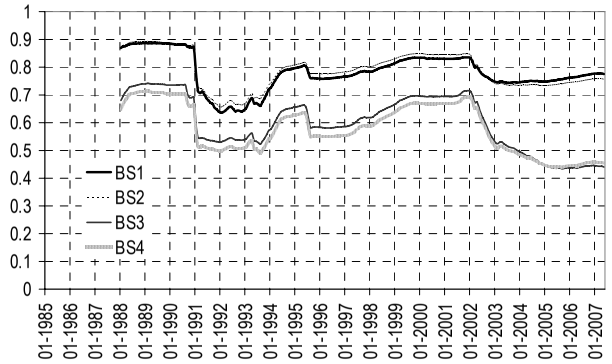
Estonia



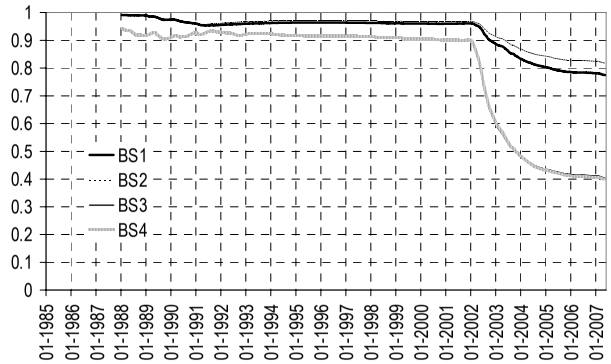
Finland



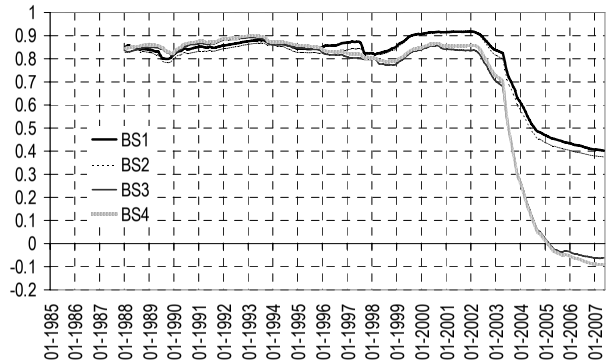
France



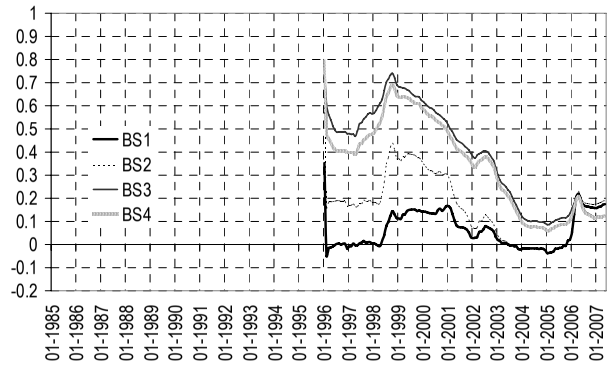
Germany



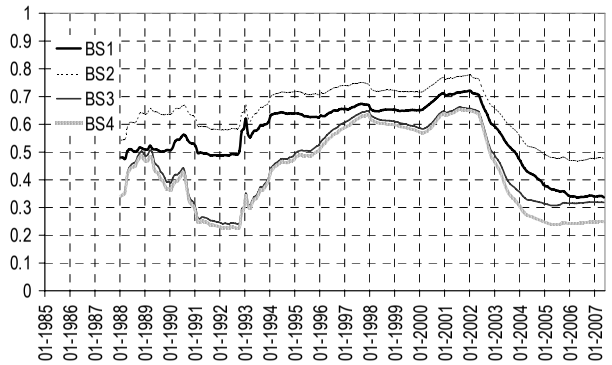
Greece



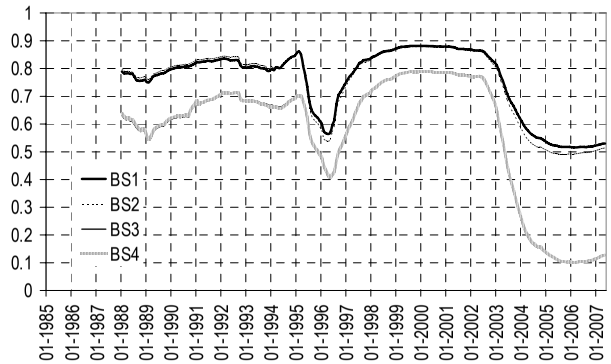
Hungary



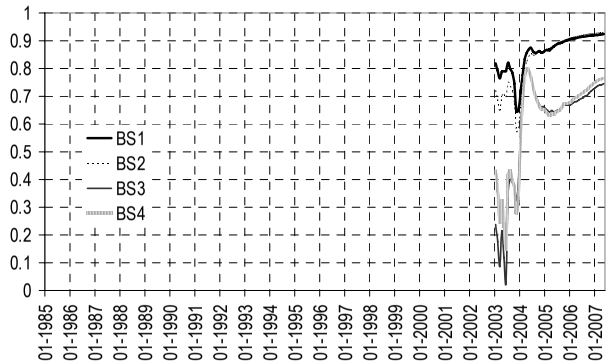
Ireland



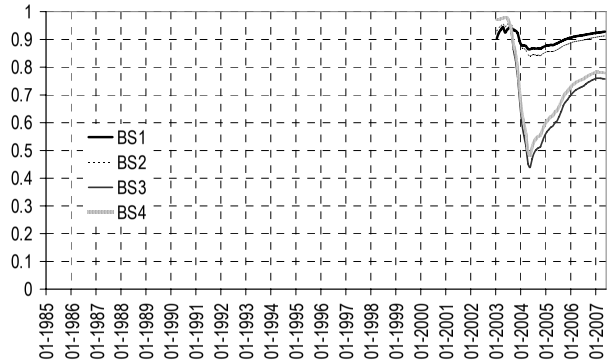
Italy



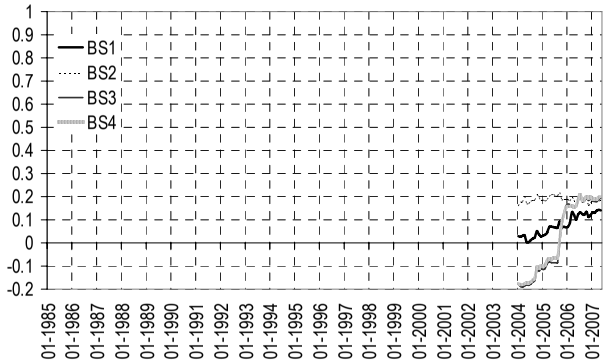
Latvia



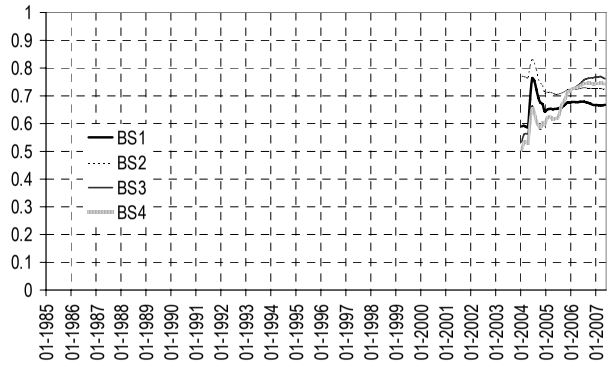
Lithuania



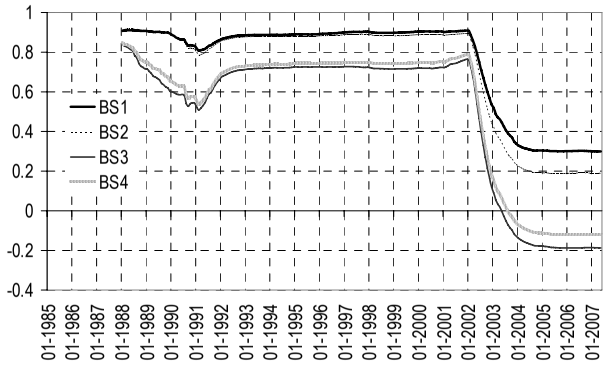
Luxembourg



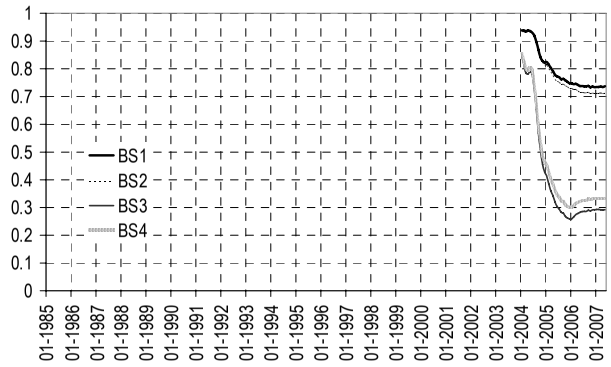
Malta



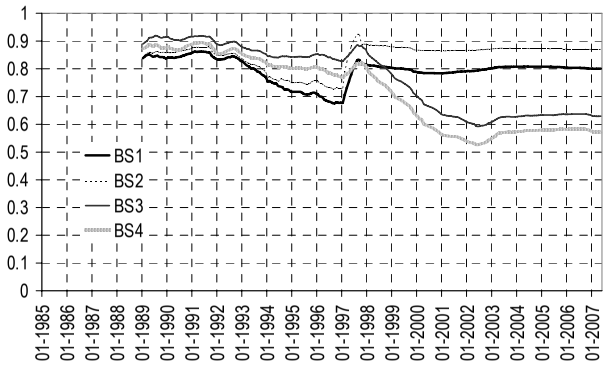
Netherlands



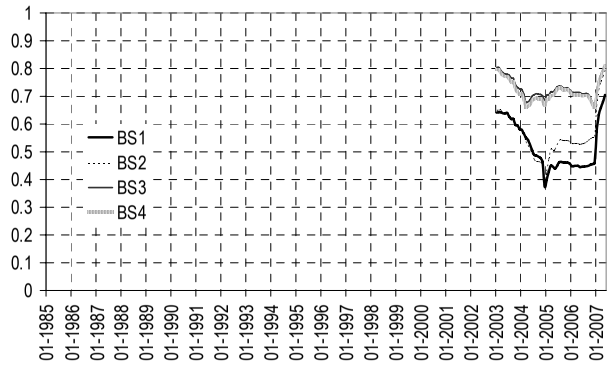
Poland



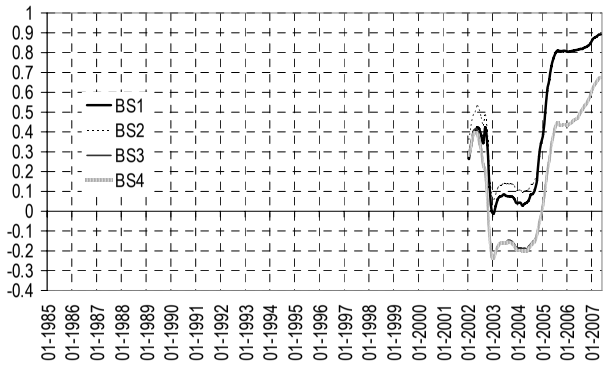
Portugal



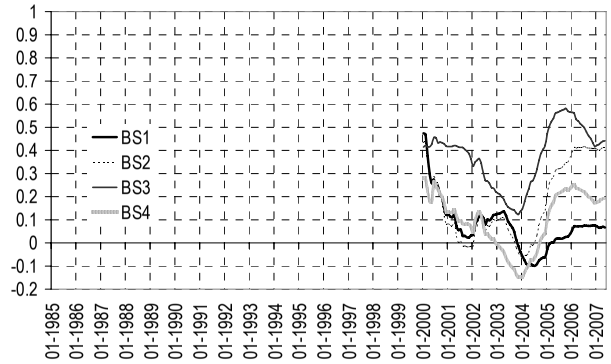
Romania



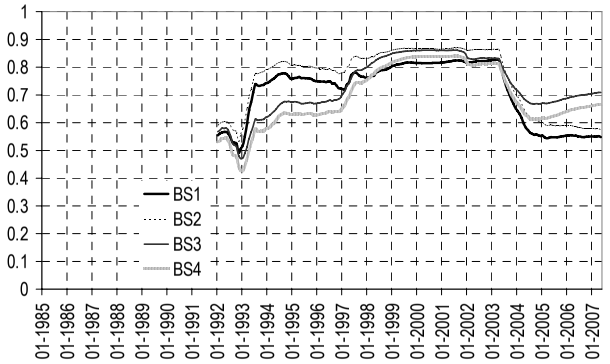
Slovakia



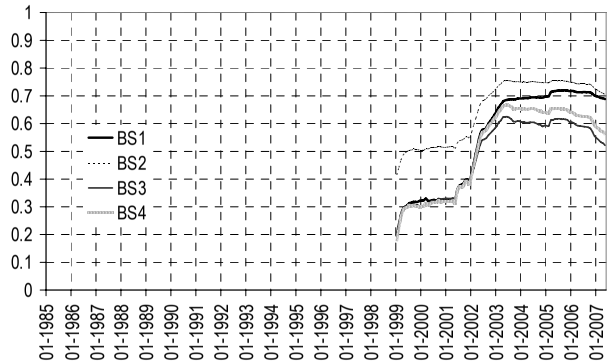
Slovenia



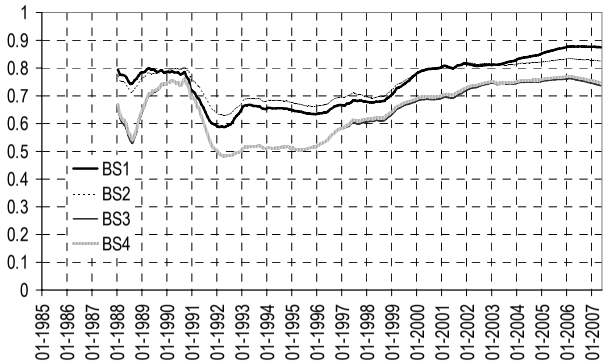
Spain



Sweden



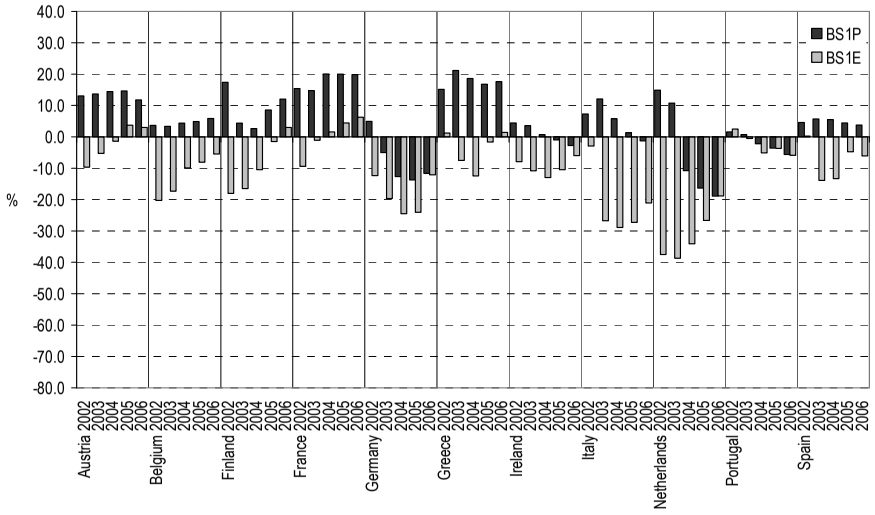
UK



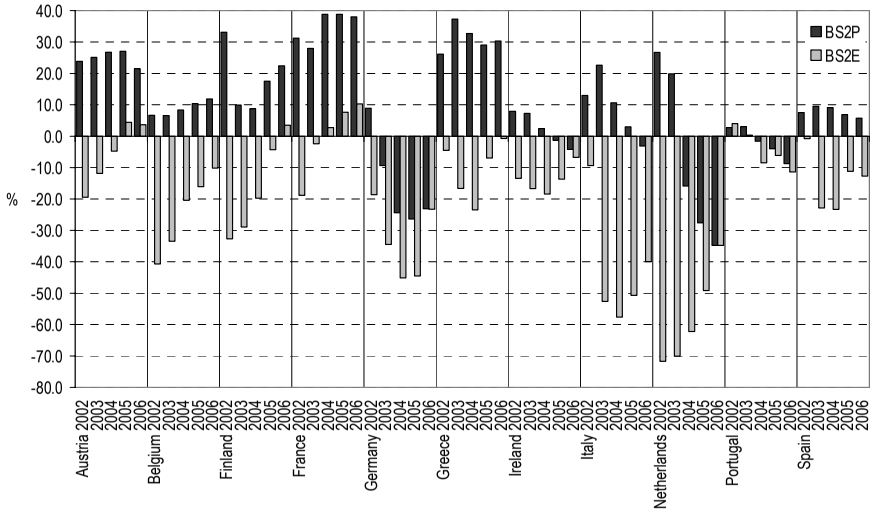
Source: own calculations on the basis of EC survey data.

Figure 8. Changes in balance statistics of perceived and expected inflation relative to 2001 average in countries launching euro in 2002†

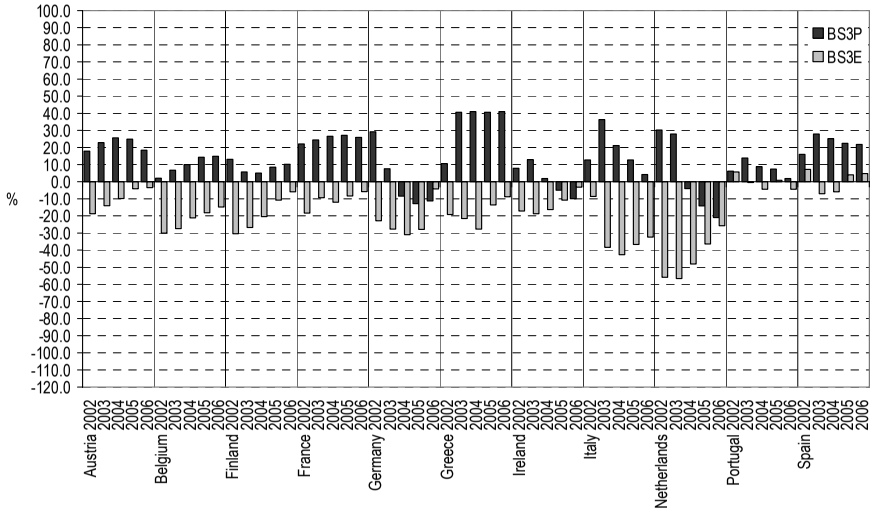
Balance statistics BS_1^P and BS_1^E



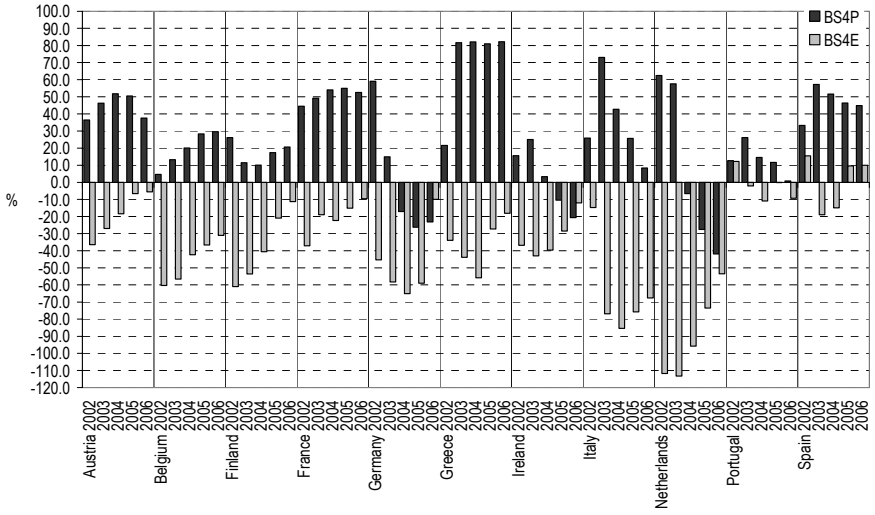
Balance statistics BS_2^P and BS_2^E



Balance statistics BS_3^P and BS_3^E

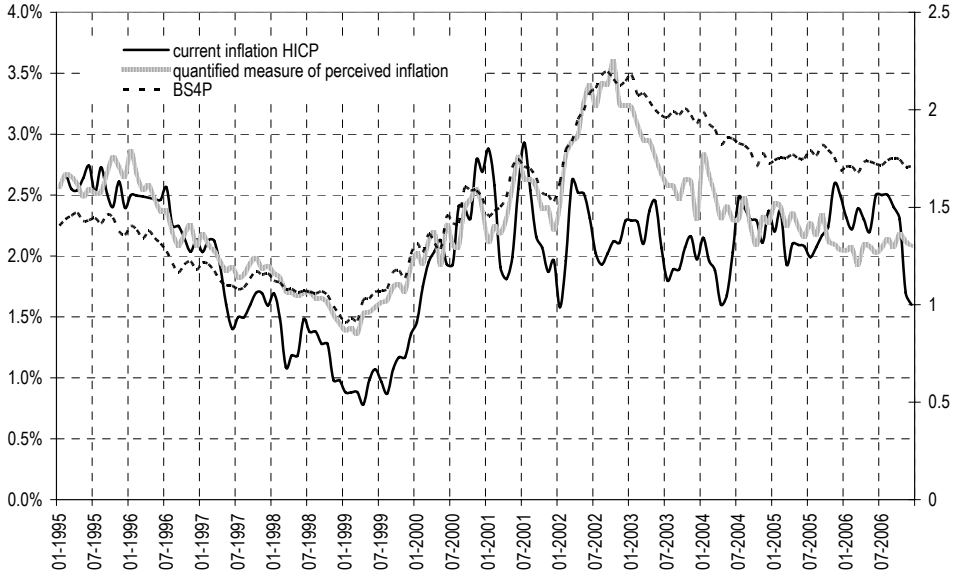


Balance statistics *BS4P* and *BS4E*



† Luxembourg not considered due to a lack of survey data for 2001.
Source: own calculations on the basis of EC survey data.

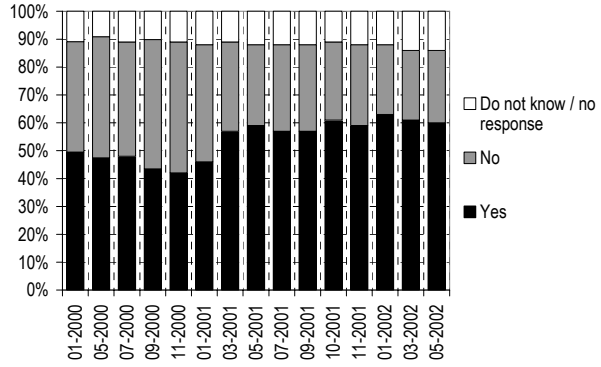
Figure 9. Inflation perception gap – two survey measures of perceived inflation vs. HICP inflation



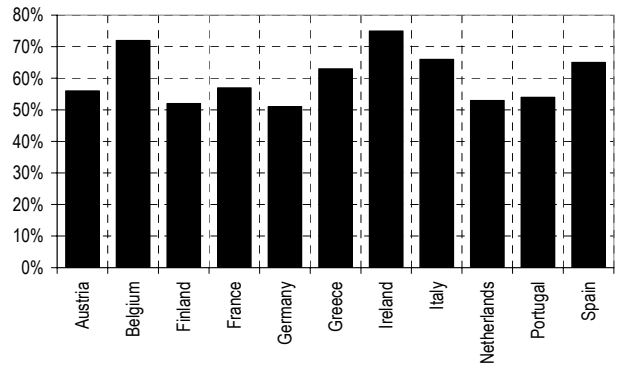
Source: own calculations on the basis of EC survey data and IFS data.

Figure 10. Opinions of the public on the impact of euro introduction on price stability

Survey responses in the euro zone, 2000-2002

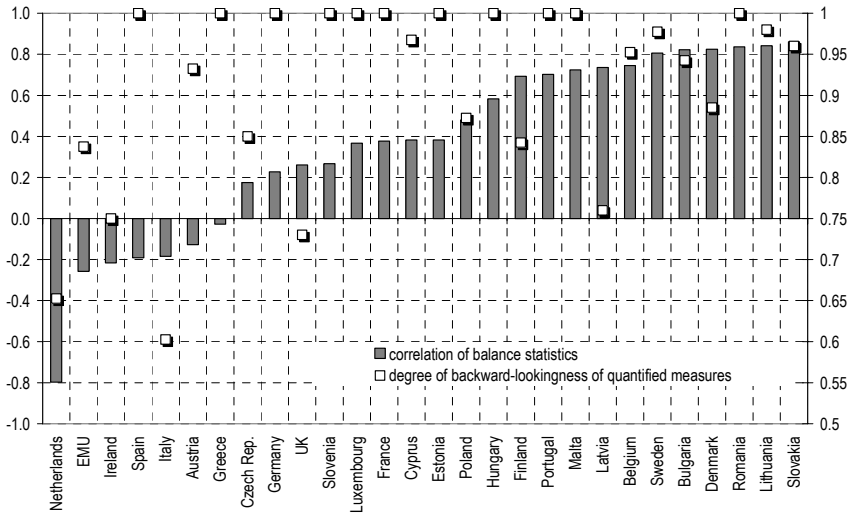


Fraction of respondents declaring that euro will contribute to price stability, November 2001



Survey question: *„Do you think that the euro will contribute to price stability in the euro zone countries?".*
Source: EOS Gallup Europe (2001), Table 15; EOS Gallup Europe (2002), Table 18, http://ec.europa.eu/public_opinion/flash

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: own calculations.

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

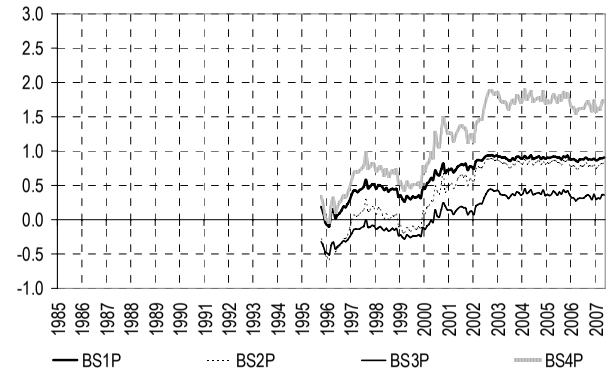
Economies, in which correlation of balance statistics of perceived and expected inflation is:	average correlation of balance statistics	average weight of backward-looking expectations
▪ negative (Netherlands, EMU)	-0.53	0.75
▪ insignificantly different from zero (Ireland, Spain, Italy, Austria, Greece, Czech Rep., Germany)	-0.10	0.86
▪ positive (UK, Slovenia, Luxembourg, France, Cyprus, Estonia, Poland, Hungary, Finland, Portugal, Malta, Latvia, Belgium, Sweden, Bulgaria, Denmark, Romania, Lithuania, Slovakia)	0.60	0.94
▪ *lower than 0.75* *(UK, Slovenia, Luxembourg, France, Cyprus, Estonia, Poland, Hungary, Finland, Portugal, Malta, Latvia, Belgium)*	*0.49*	*0.94*
▪ *higher than 0.75* *(Sweden, Bulgaria, Denmark, Romania, Lithuania, Slovakia)*	*0.83*	*0.96*

Source: own calculations.

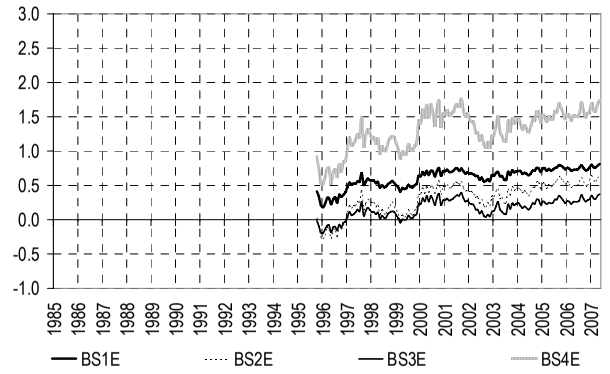
Annex A

Figure A1. Balance statistics of inflation perception and expectations

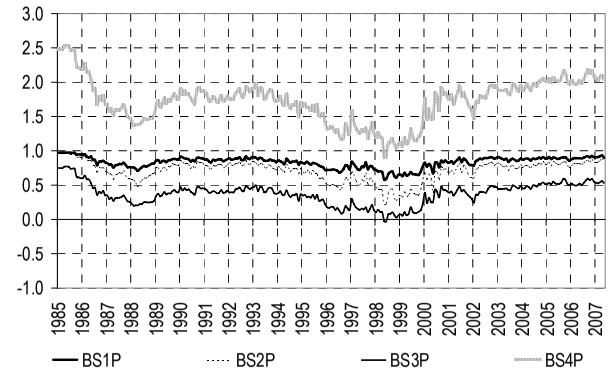
Austria – perception



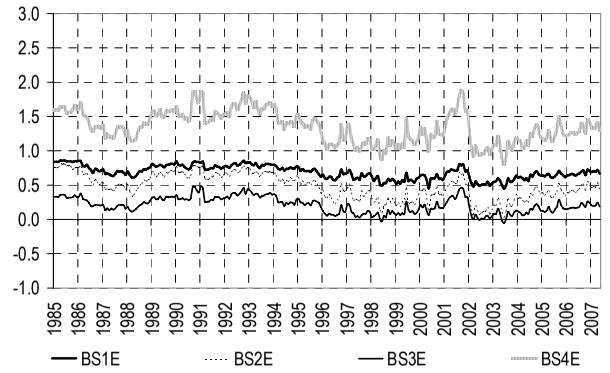
Austria – expectations



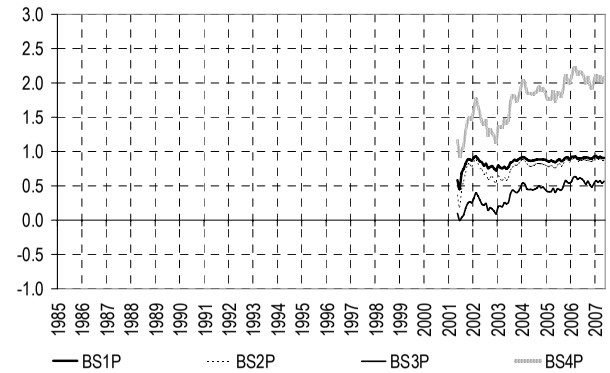
Belgium – perception



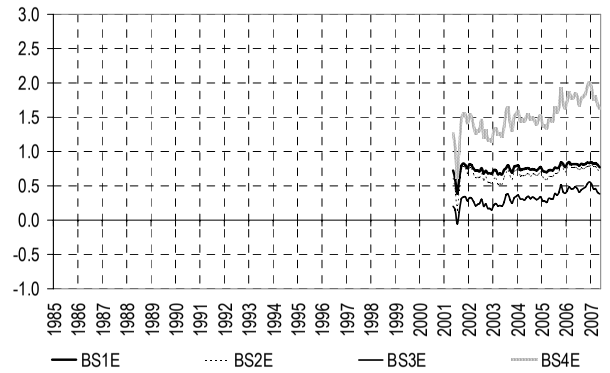
Belgium – expectations



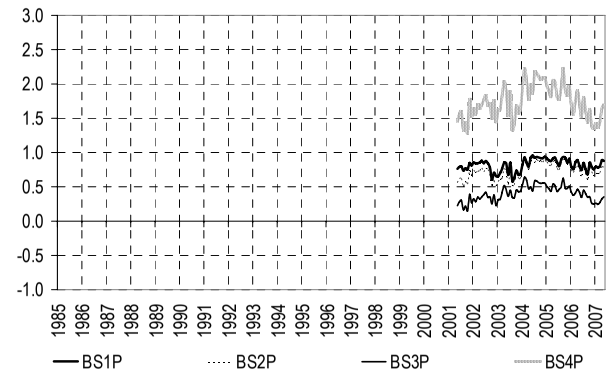
Bulgaria – perception



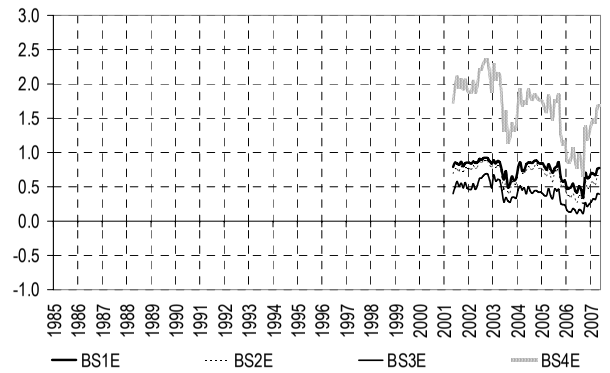
Bulgaria – expectations



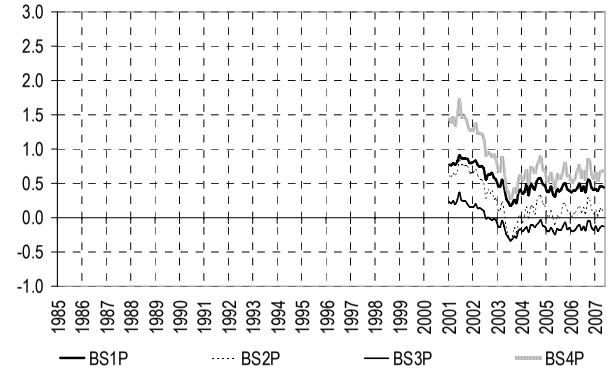
Cyprus – perception



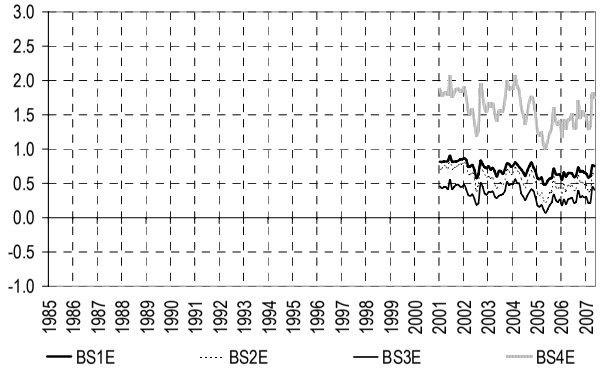
Cyprus – expectations



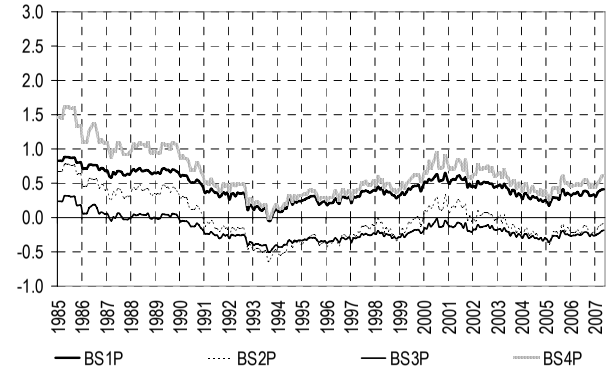
Czech Rep. – perception



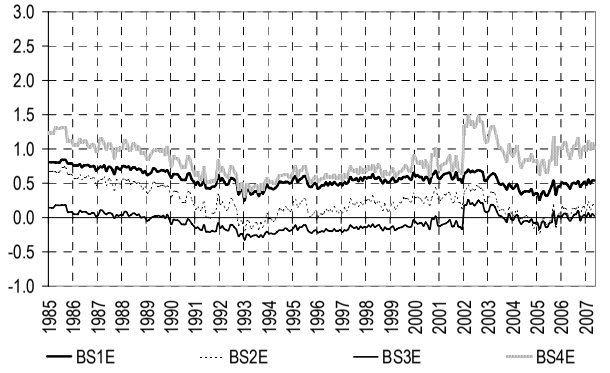
Czech Rep. – expectations



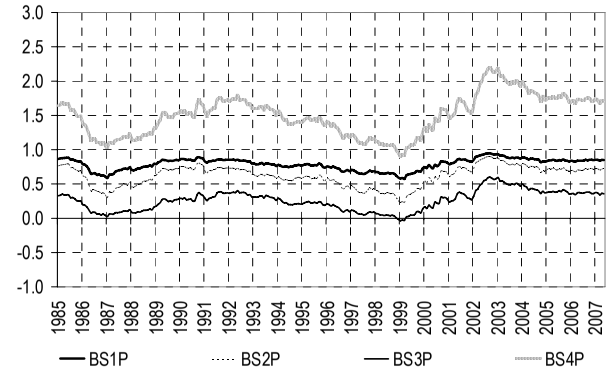
Denmark – perception



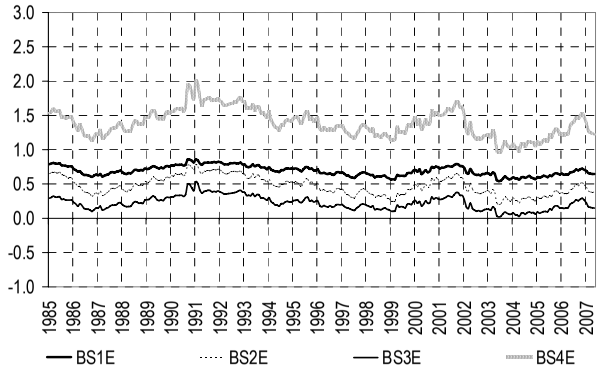
Denmark – expectations



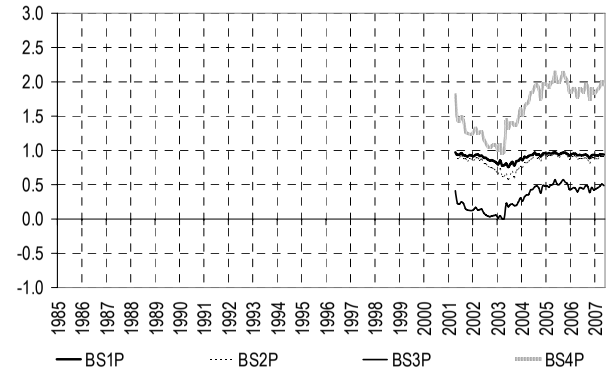
EMU – perception



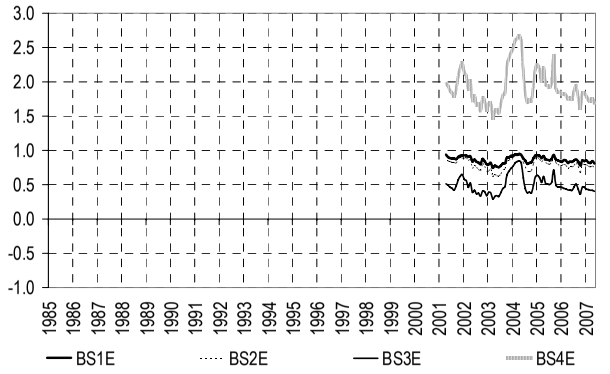
EMU – expectations



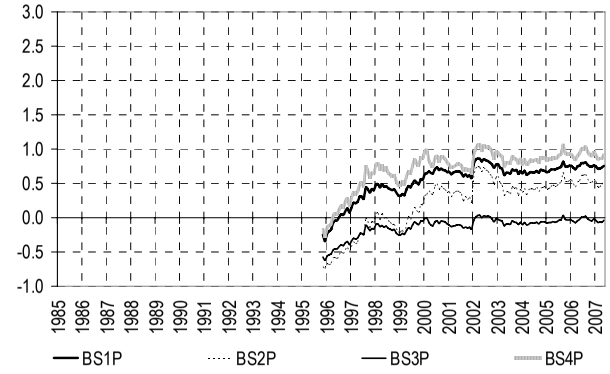
Estonia – perception



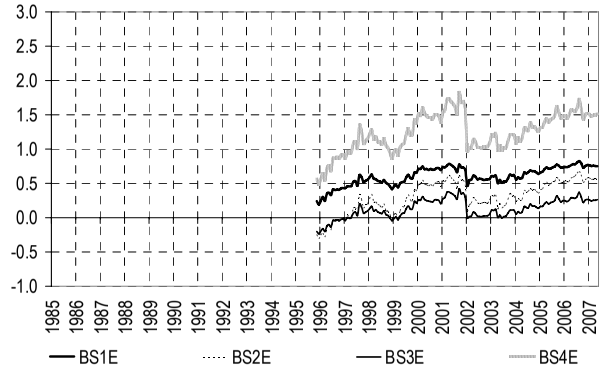
Estonia – expectations



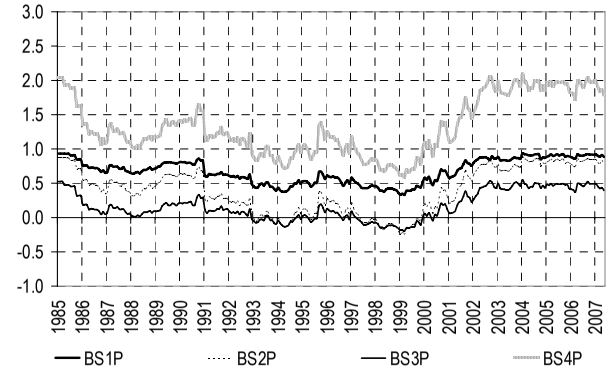
Finland – perception



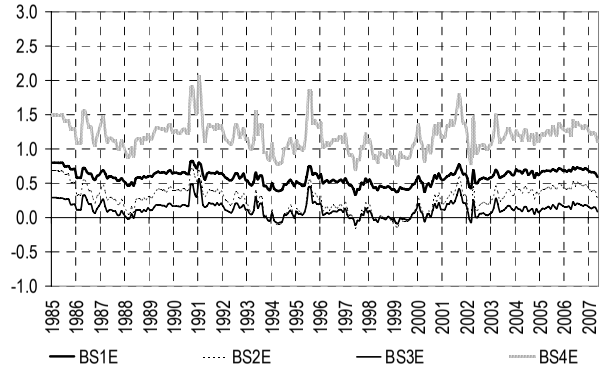
Finland – expectations



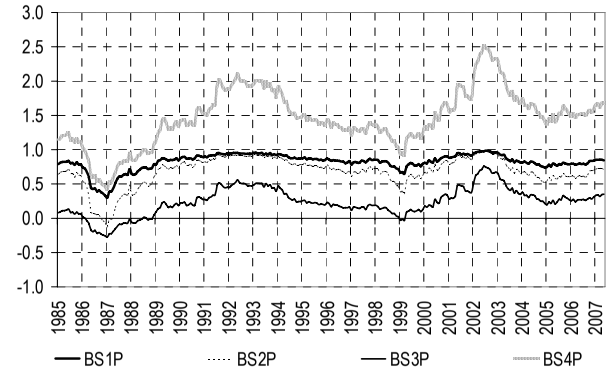
France – perception



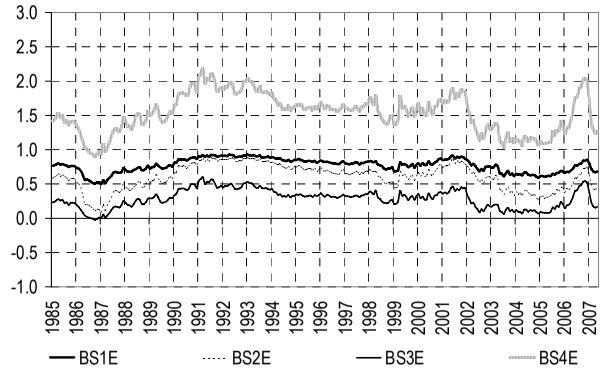
France – expectations



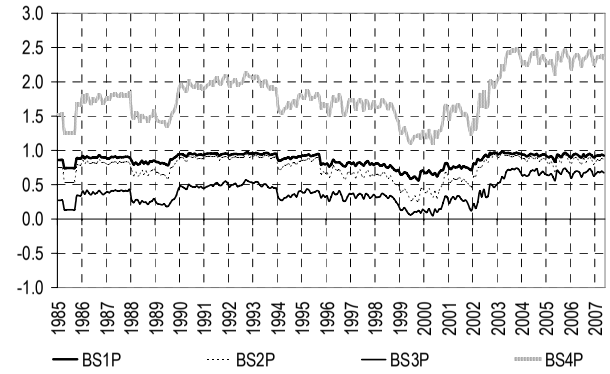
Germany – perception



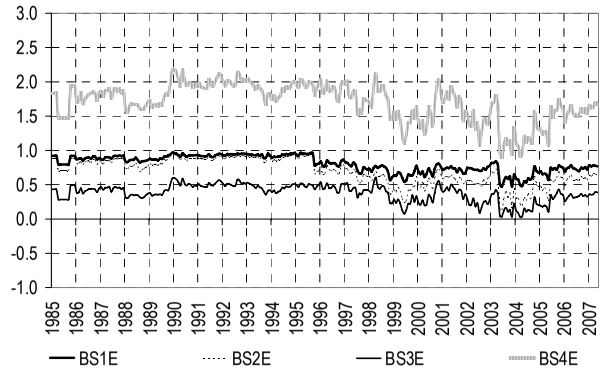
Germany – expectations



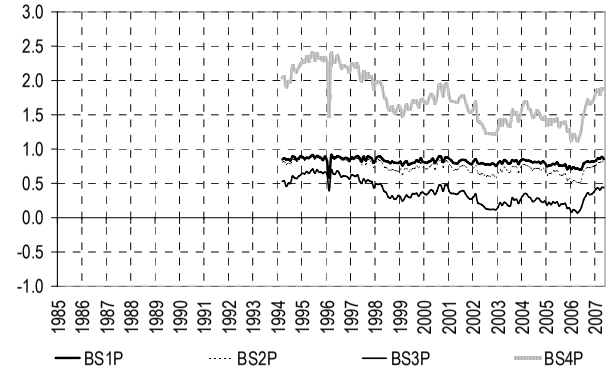
Greece – perception



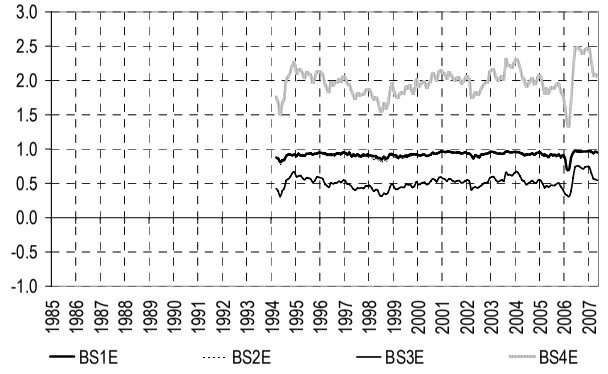
Greece – expectations



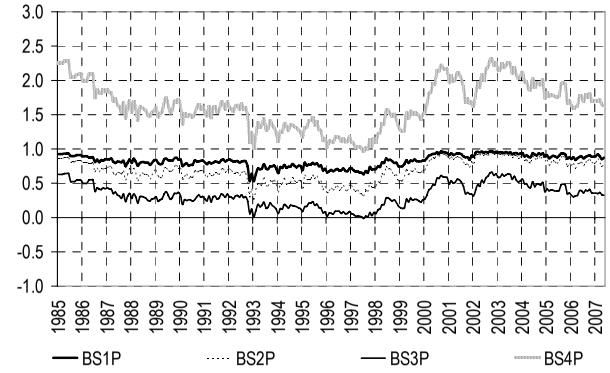
Hungary – perception



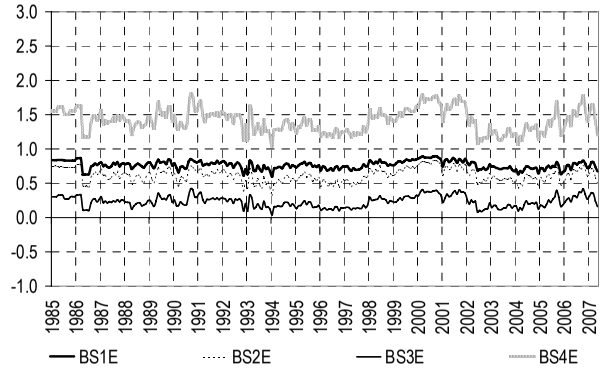
Hungary – expectations



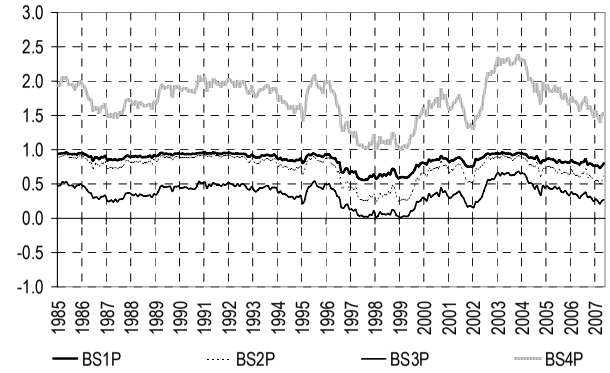
Ireland – perception



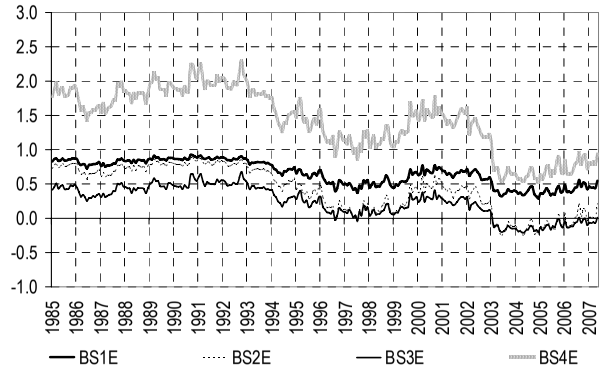
Ireland – expectations



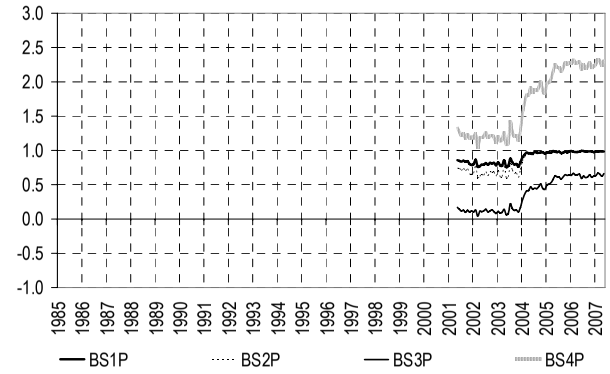
Italy – perception



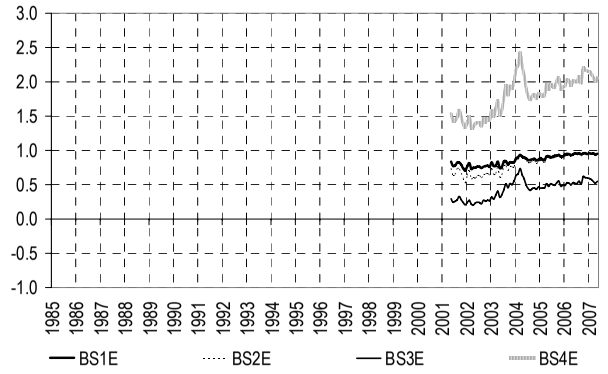
Italy – expectations



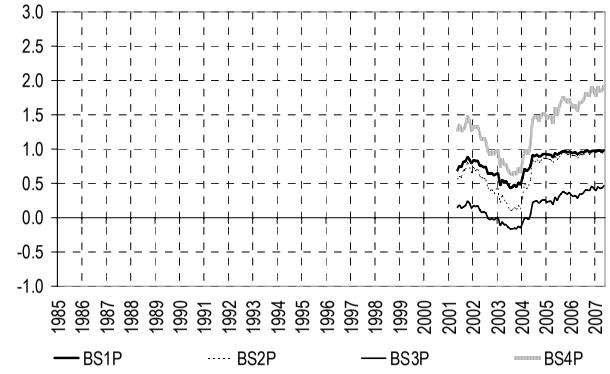
Latvia – perception



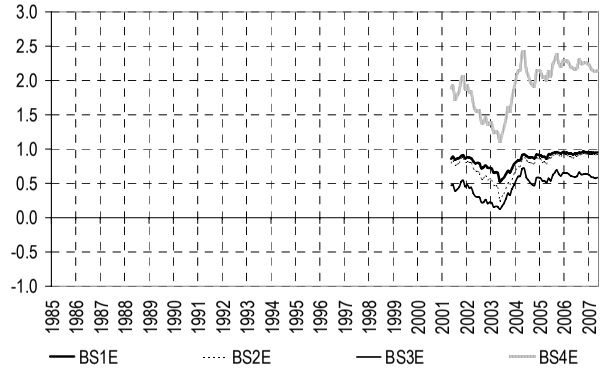
Latvia – expectations



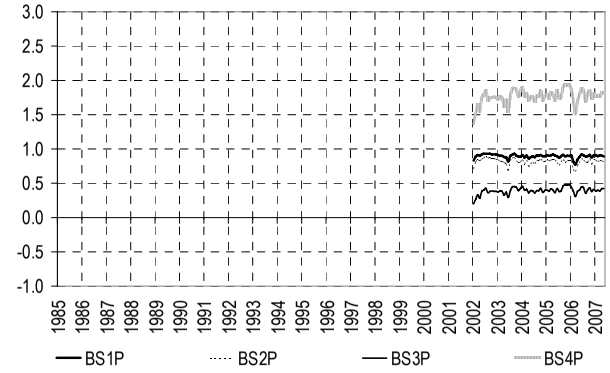
Lithuania – perception



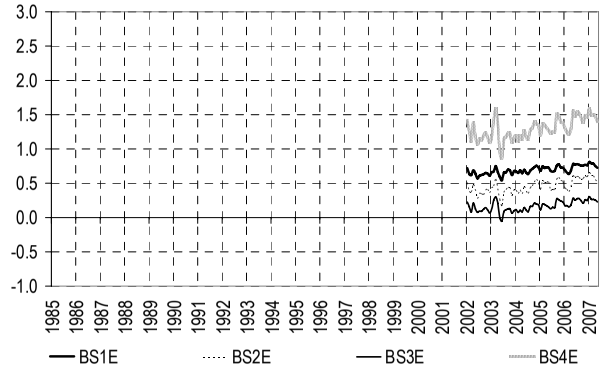
Lithuania – expectations



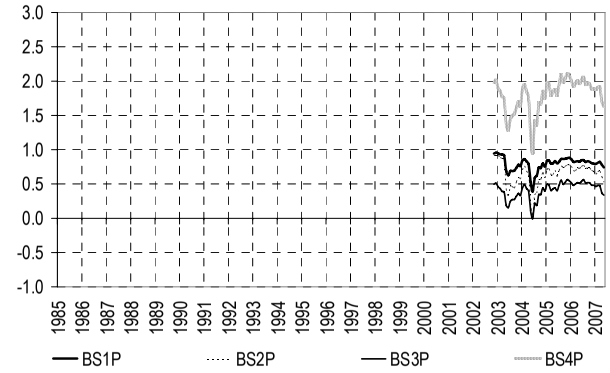
Luxembourg – perception



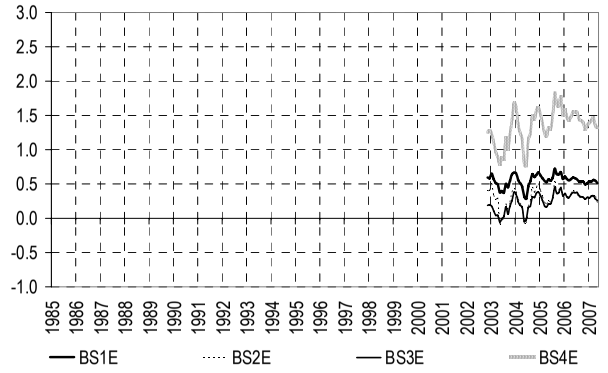
Luxembourg – expectations



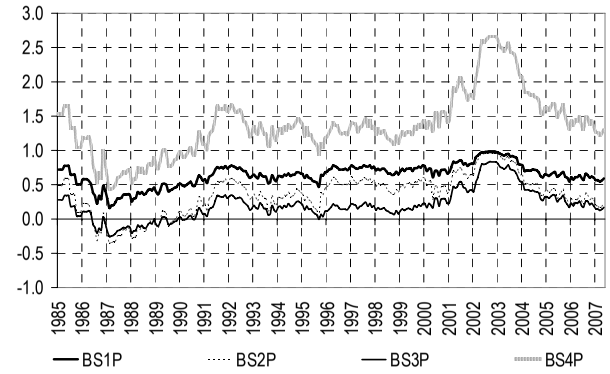
Malta – perception



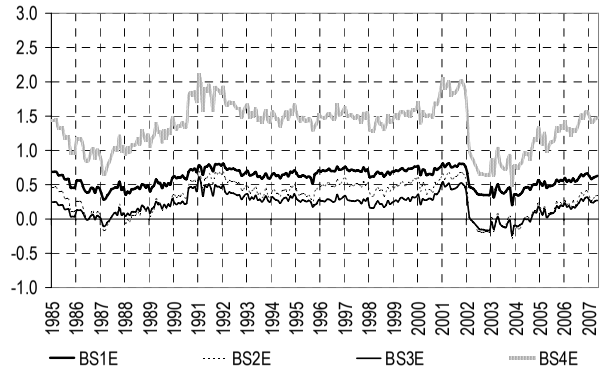
Malta – expectations



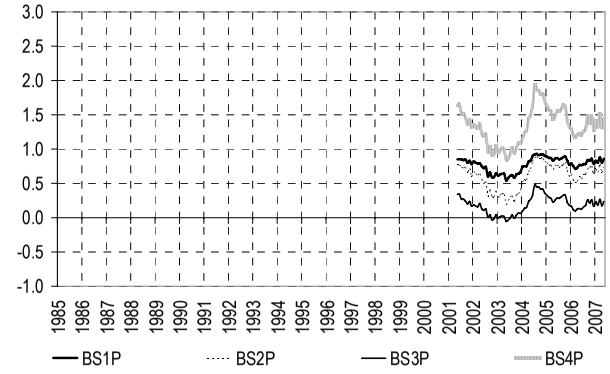
Netherlands – perception



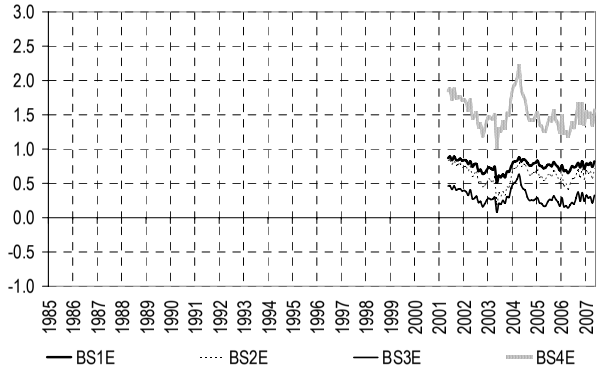
Netherlands – expectations



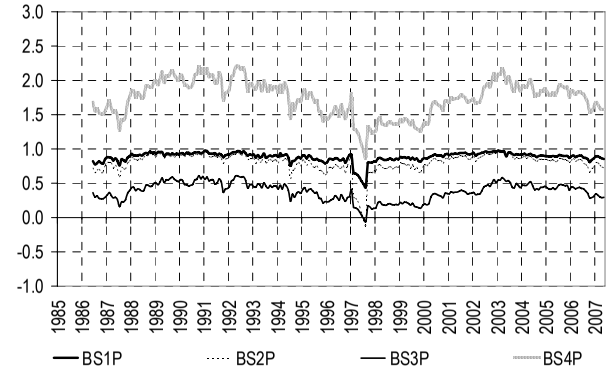
Poland – perception (GfK Polonia)



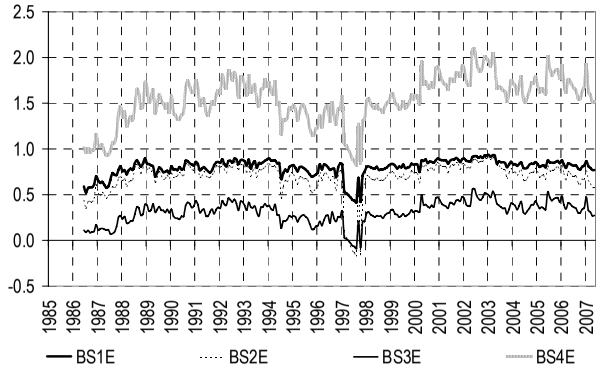
Poland – expectations (GfK Polonia)



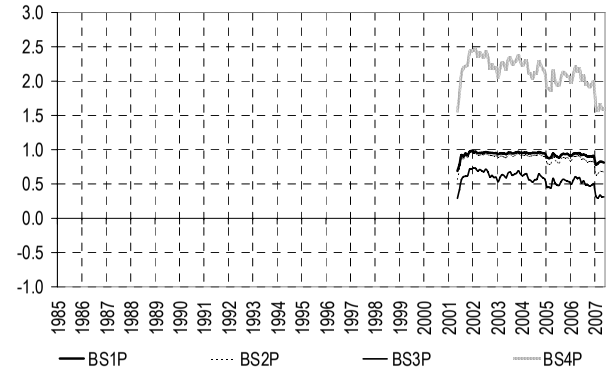
Portugal – perception



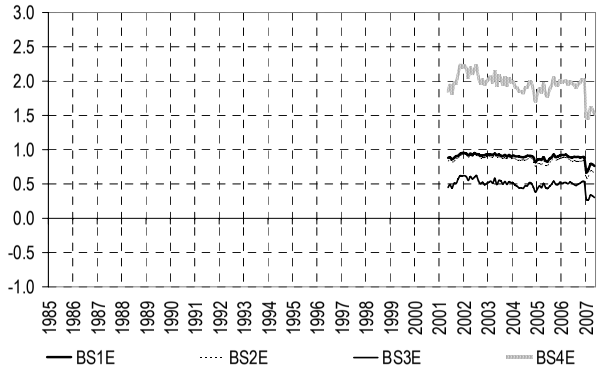
Portugal – expectations



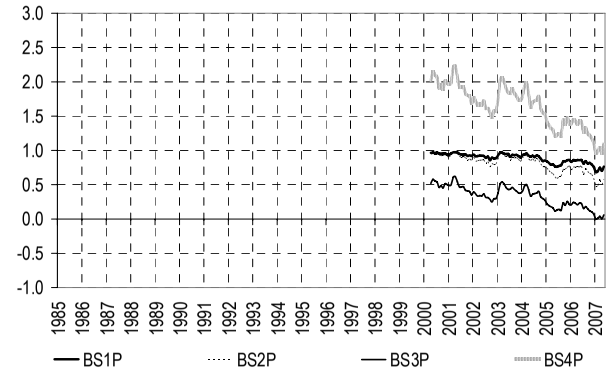
Romania – perception



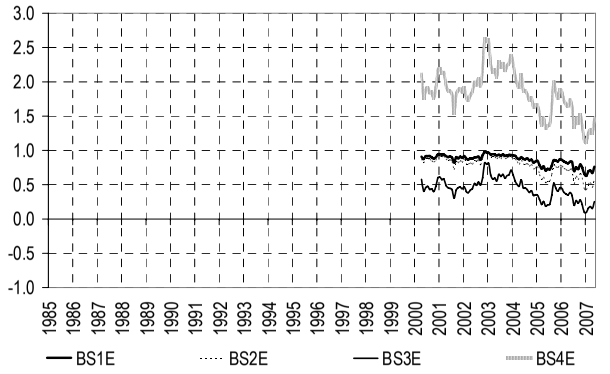
Romania – expectations



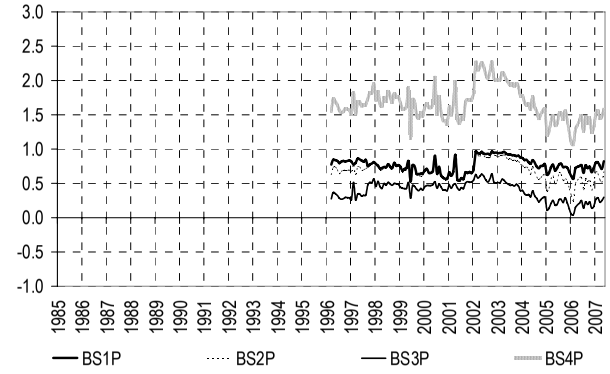
Slovakia – perception



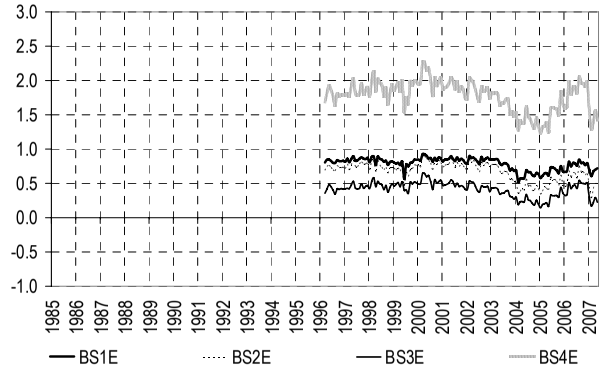
Slovakia – expectations



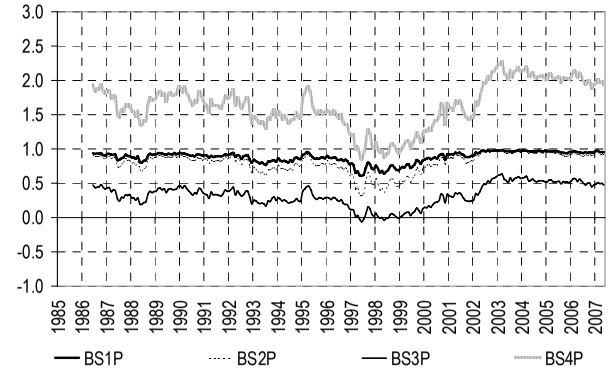
Slovenia – perception



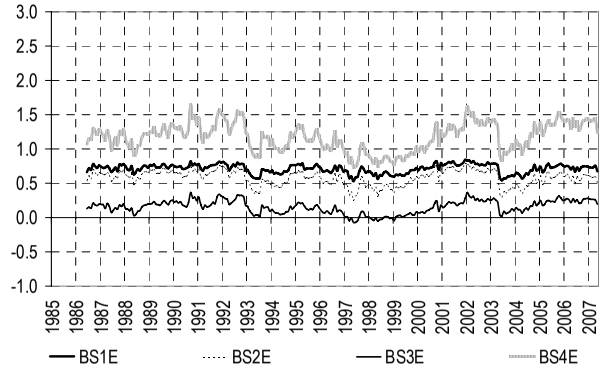
Slovenia – expectations



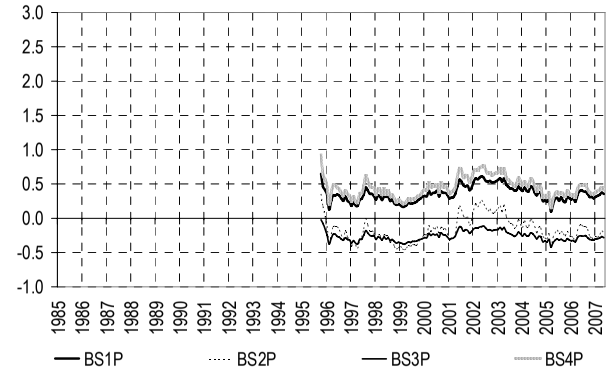
Spain – perception



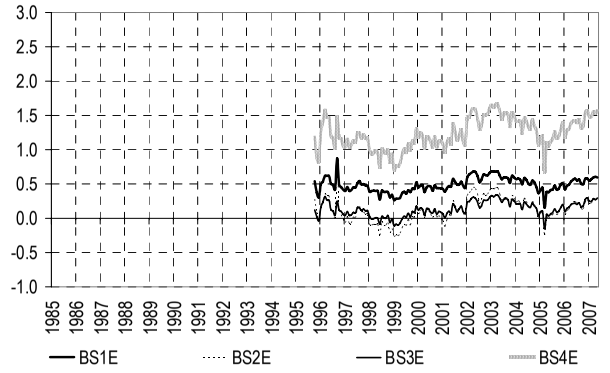
Spain – expectations



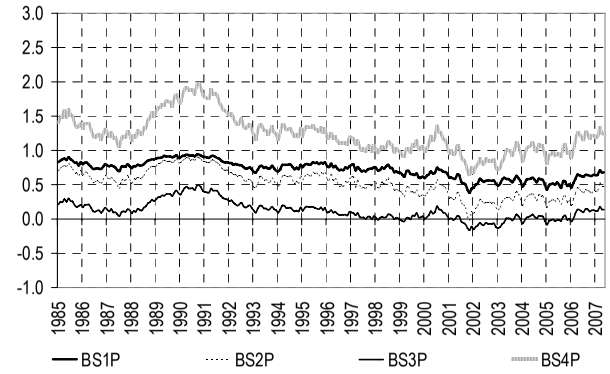
Sweden – perception



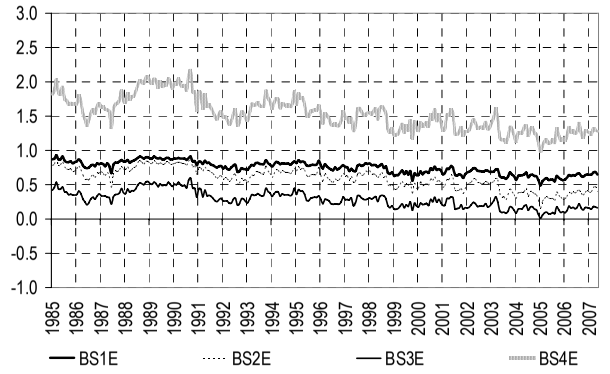
Sweden – expectations



UK – perception



UK – expectations



Source: own 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:	1985.03-2007.05	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:	1986.03-2007.05	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:	1985.03-2007.05	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:	1985.05-2007.05	Standard errors in parentheses.
R^2 sadj.:	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:	1986.03-2007.05	Standard errors in parentheses.
R^2 adj.:	0.91	

Latvia – regression model based on the balance statistics *BS4*

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

Sample:	2001:05-2007.05	Standard errors in parentheses.
R^2 adj.:	0.82	

Lithuania – regression model based on the balance statistics *BS4*

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

Sample:	2001:05-2007.05	Standard errors in parentheses.
R^2 adj.:	0.81	

Malta – Smith and McAleer (1995) regression model

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

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

Sample:	2003:11-2007.05	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:	2002.05-2007.05	Standard errors in parentheses.
R^2 adj.:	0.74	

UK – Smith and McAleer (1995) regression model

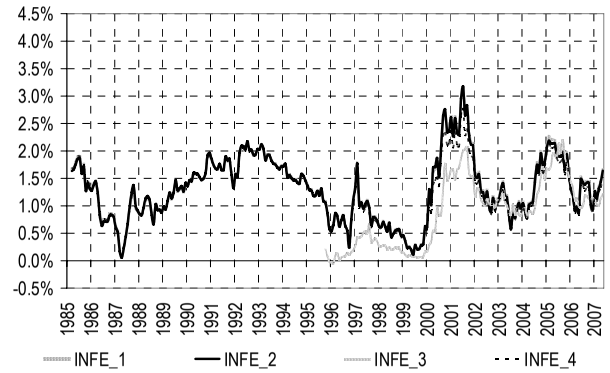
$$\pi_{0t} = \frac{\sum_{i=1}^{3} A_{it}^{p} \cdot \left(\underset{(0.001)}{0.012} + \underset{(0.006)}{0.010} \cdot \sum_{i=1}^{12} \pi_{0,t-i} \right)}{1 - \underset{(0.066)}{0.825} \cdot \sum_{k=1}^{3} A_{kt}^{p}} + \varepsilon_t$$

Sample:	1986.03-2007.05	Standard errors in parentheses.
R^2 adj.:	0.80	

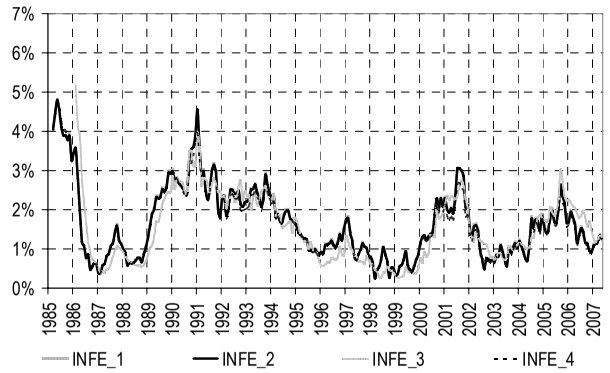
Annex C

Figure 12. Quantified measures of inflation expectations

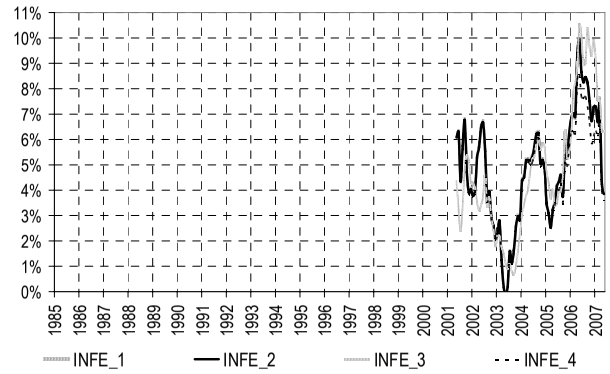
Austria



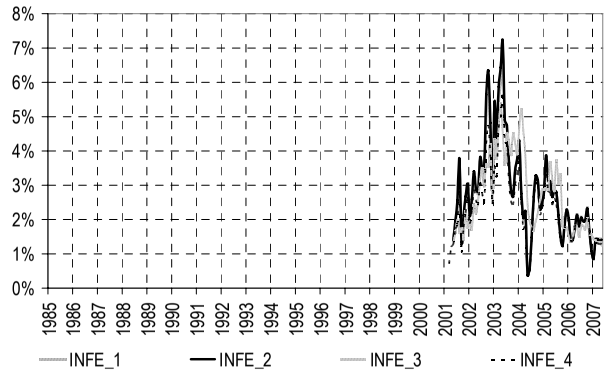
Belgium



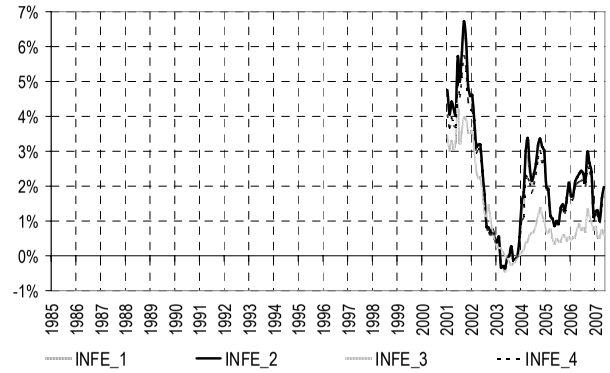
Bulgaria



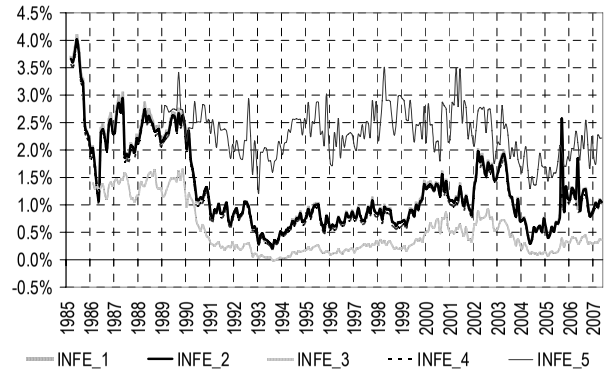
Cyprus



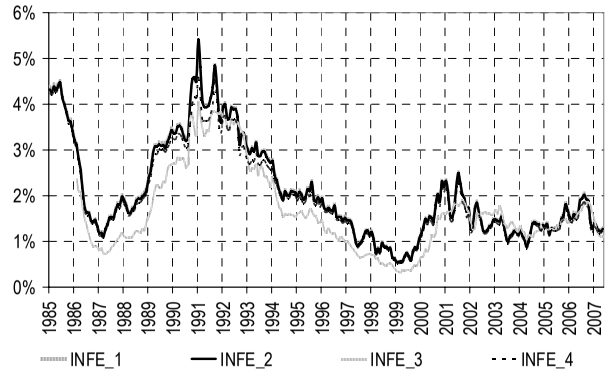
Czech Republic



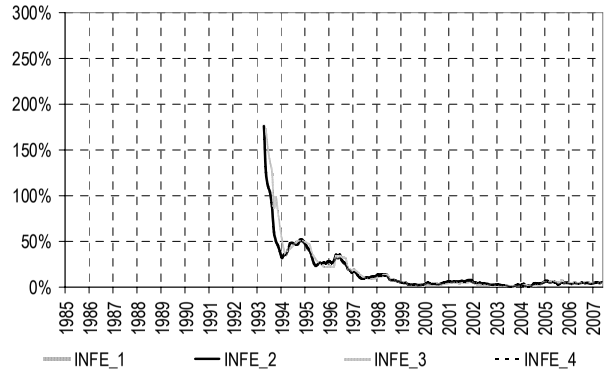
Denmark



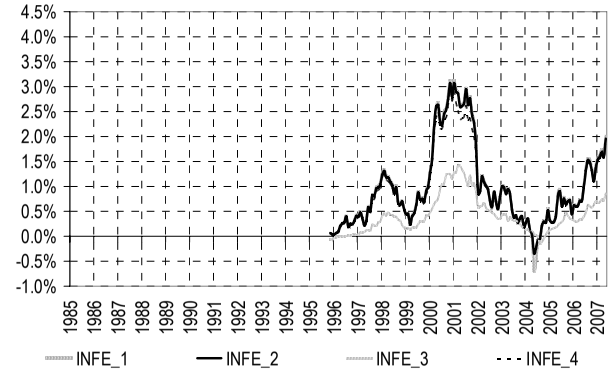
EMU



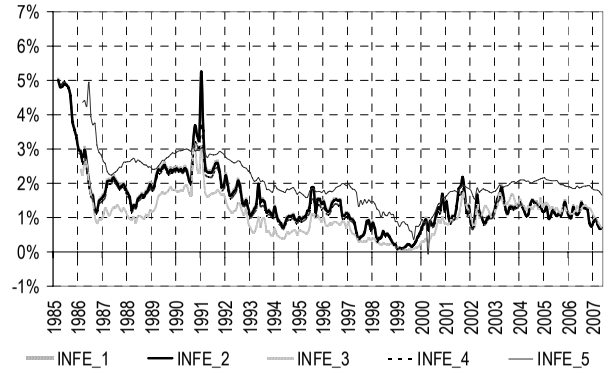
Estonia



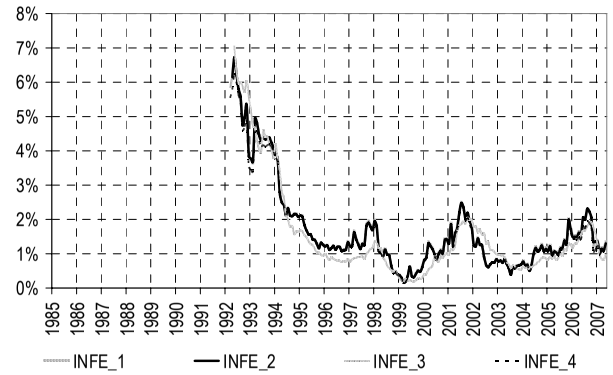
Finland



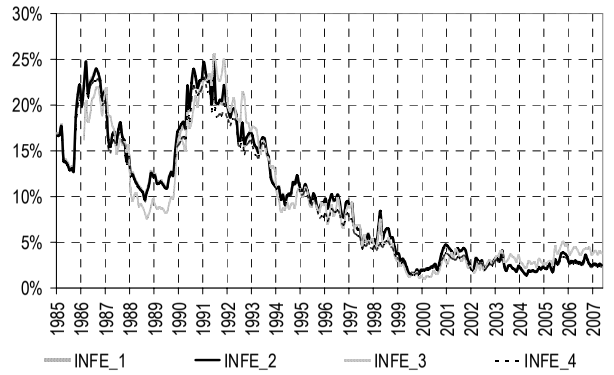
France



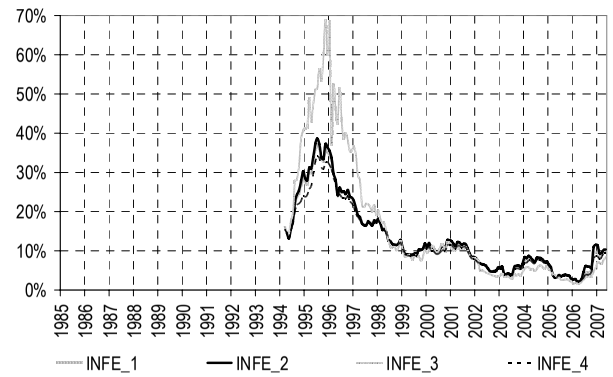
Germany



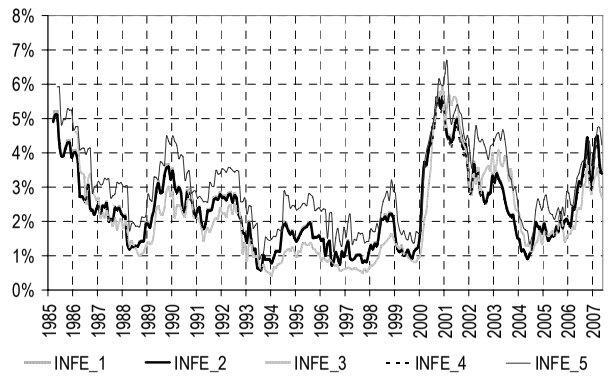
Greece



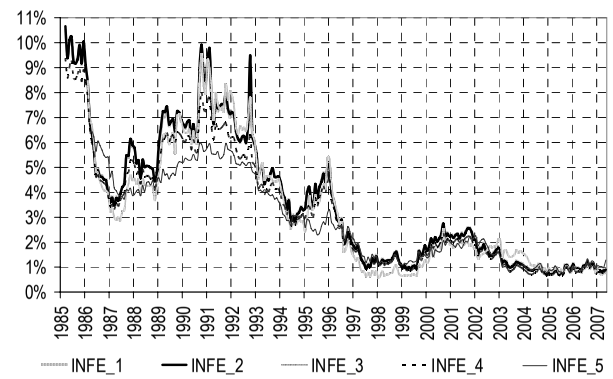
Hungary



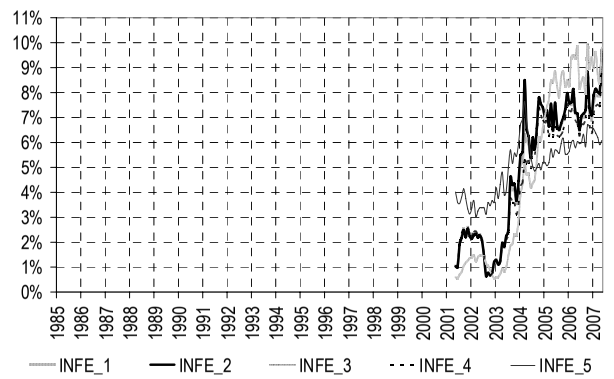
Ireland



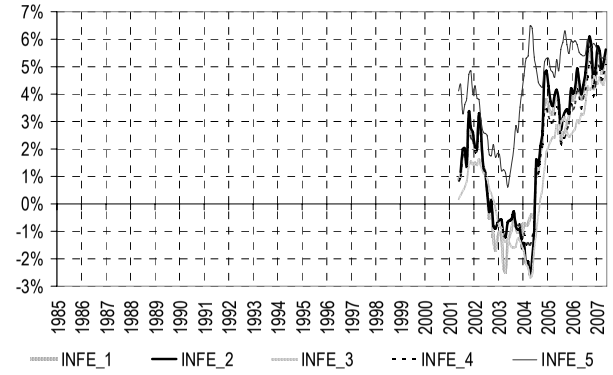
Italy



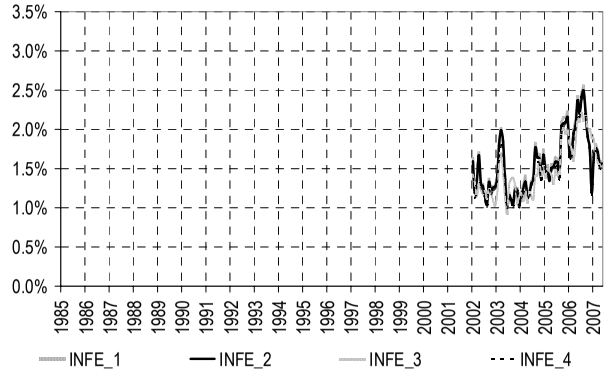
Latvia



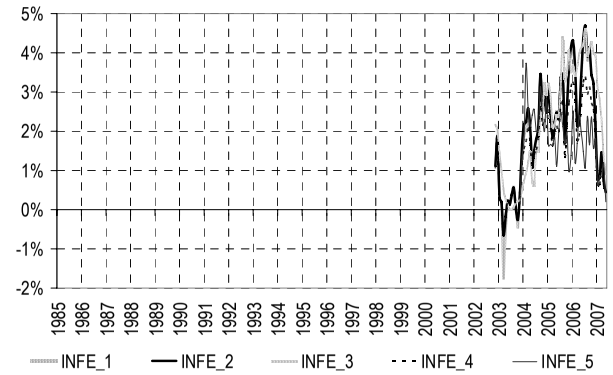
Lithuania



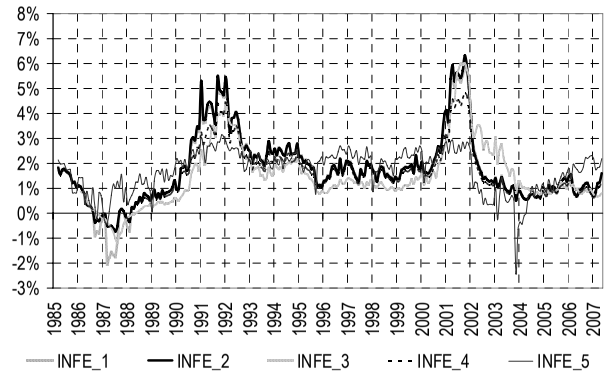
Luxembourg



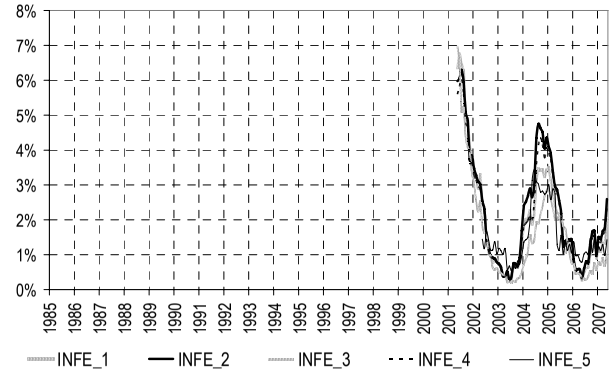
Malta



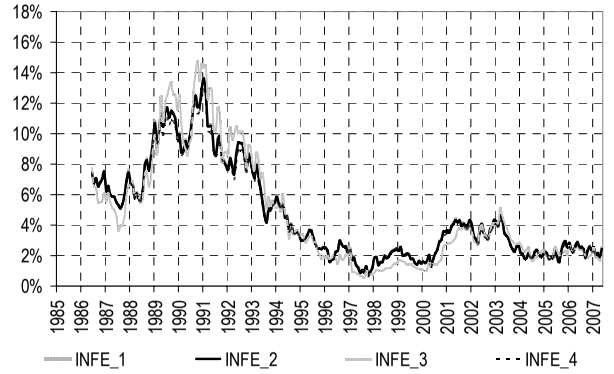
Netherlands



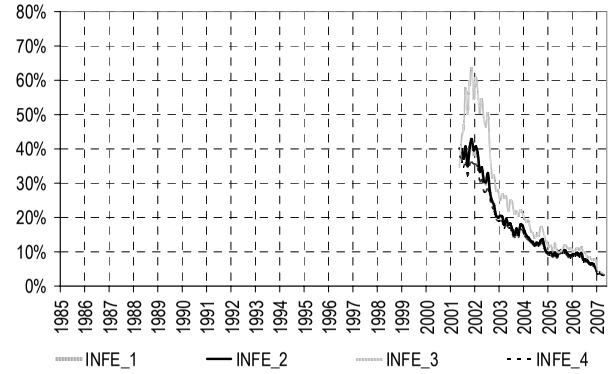
Poland



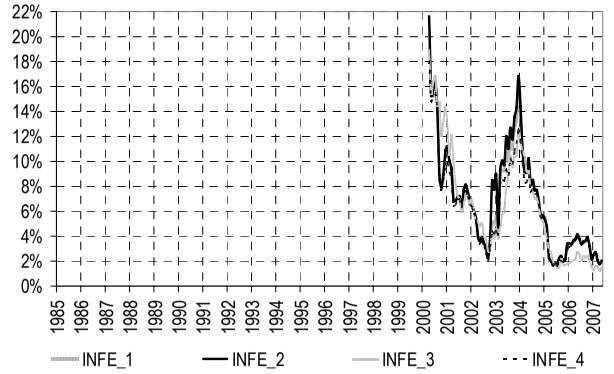
Portugal



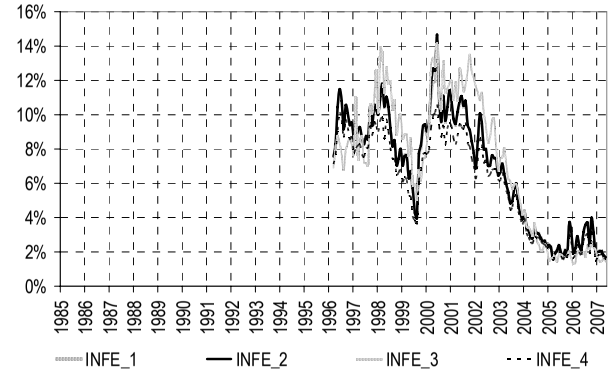
Romania



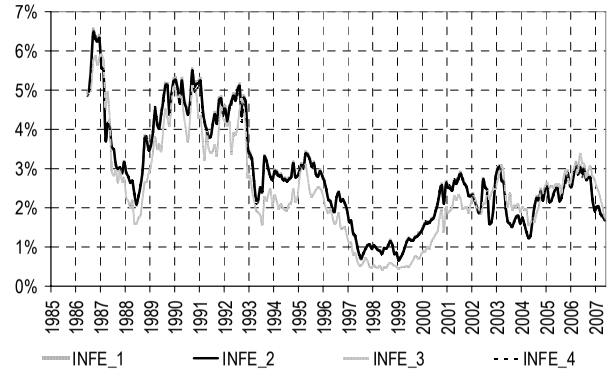
Slovakia



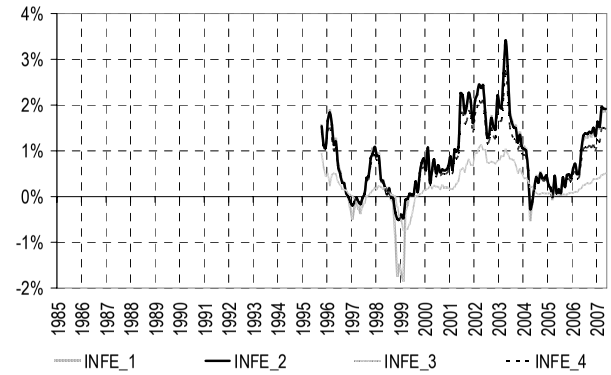
Slovenia



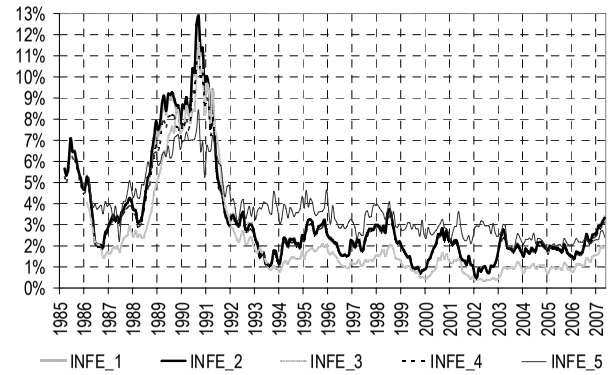
Spain



Sweden



UK



Source: own calculations on the basis of EC and IFS data.