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Very preliminary – work in progress

**The forecasting horizon of inflationary expectations and perceptions in the EU –
Is it really 12 months?**

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Abstract:

The standard way today to obtain measures of inflationary expectations is to turn to a representative group of respondents and ask them, using questionnaires, about their beliefs of the future rate of inflation during the coming 12 months. This type of data on inflationary expectations as well as on inflationary perceptions has now been collected in a unified way on an EU-wide basis for several years. By now, probably the largest database on inflationary expectations has been built in this way.

We use this database to explore the forecasting horizons implicitly used by the respondents to questions about the expected rate of inflation during the coming 12 months in all EU member states that have supplied DG ECFIN with relevant data. We examine the forecast errors, the mean error and the RMSEs, to study if the forecast horizon is truly 12 months. We expect a U-shaped pattern for the forecast error reaching its lowest value for the 12-month horizon. We also study the backcast error for inflationary perceptions in a similar way.

Our results show large differences across countries. For several countries, we get the expected U-shaped outcome for the forecast errors, for others this is not the case. Furthermore, the horizon implicitly used by respondents is not related to the questions. When respondents have a 12 month forecast horizon for their expectations, their perceptions are also forward looking, and vice versa.

Key words: Inflationary expectations, perceptions, forecasting error, forecasting horizon, EU, euro, the euro area.

JEL classification:

The forecasting horizon of inflationary expectations and perceptions in the EU – Is it really 12 months?

1. Introduction

Inflationary expectations held by the public are important for macroeconomic policy-making. According to the present approach to monetary policy-making based on inflation targeting, central banks should be forward-looking, framing the policy today on the basis of forecasts of the future rate of inflation one to two years ahead. This approach requires access to reliable and frequently reported data on inflationary expectations of the public. However, such information is lacking for the simple reason that inflationary expectations are not directly measurable in a way similar to aggregates such as interest rates, money supplies, rates of unemployment, consumer and producer prices etc.

An important way, and today the standard method, to construct measures of inflationary expectations is to turn to a representative group of respondents and ask them, using questionnaires, about their beliefs of the future rate of inflation. This type of data on inflationary expectations and perceptions has now been collected in a unified way on an EU-wide basis allowing for the build up of the largest database on inflationary expectations existing anywhere. (See Lindén (2006) for a recent survey). It contains by now more than one million replies concerning the expected rate of inflation 12 months ahead in time.

The characteristics of inflationary expectations as measured by interviews have been examined in a large number of studies concerning issues like rationality, distribution, differences across socio-economic groups, uncertainty etc. Here we exploit the new EU database gathered within the Joint Harmonised EU Programme of Consumer Survey to examine an issue that so far – at least to the best of our knowledge - has not been studied in depth; the forecasting horizon used by the respondents. In short, respondents are asked about a forecast for 12 months ahead. However, it is an open question for which horizon they actually give the best forecast; that is the forecast with the smallest forecast error. This issue is explored in this paper. We do the same type of test for the properties concerning the perceived

rate of inflation; that is the rate of inflation perceived by the respondents during the past 12 months.

Our study is organized in the following way. First we describe the methodology applied, second the data that we use. Then we present our results in a set of tables and charts. A fifth section concludes.

2. Methodology

We explore the forecasting horizons implicitly used by the respondents to questions about the expected rate of inflation during the coming 12 months in all EU member states that have supplied DG ECFIN with relevant data, which have been checked and processed in a unified way. Here respondents are asked to give their expectations over a forecast horizon of 12 months. All econometric work using such data assumes implicitly that this is also the relevant horizon to use. It remains, however, an empirical issue to what extent respondents actually have a forecast horizon of 12 months in their minds when responding to the questions about the future rate of inflation. We examine this issue by comparing the forecast error for varying forecasting horizons, starting from zero going up to 24 months. We examine the forecast errors in different ways, using the mean error and the root mean squared error (RMSE).

If the forecast horizon is truly 12 months, we expect a minimum for the forecast error, leaving aside for the moment how we measure the forecast error, at the 12-month horizon. We do not expect to find the forecast error to be zero at the 12-month horizon, only to be at a minimum at the 12-month horizon. At least for the RMSEs, we would expect a U-shaped pattern for the forecast error like the solid stylised curve in Chart 1.

For the backcast error, that is the difference between the actual rate of inflation and the perceived rate, we expect a minimum for contemporaneous observations. Thus we expect a stylised curve like the dashed one in Chart 1.

We carry out our empirical investigations for every country for which data are currently available. We also pool the data. We make a distinction between countries that have adopted the euro and those who have not (see column 7 in Table 1), as the introduction of the single currency influenced perceptions of inflation to a significant degree.

3. Data used

The data used are taken from the Joint Harmonised Programme of Consumer Surveys for the European Union. National institutes in each of the 27 participating countries conduct these surveys. The harmonised questionnaire contains questions on the economic situation of the household and the country where the respondent resides. Parallel with two qualitative questions on price developments, two additional price questions were introduced in 2003 on an experimental basis. These two questions ask respondents to quantify past and future inflation and give their responses in percent. A more comprehensive description of the harmonised EU survey programme can be found in the European Economy, No 6, 1997 and the European Economy, No 5, 2006.

The quantitative formulation of the price questions are currently implemented in 25 out of 27 national questionnaires. In most cases the questions were introduced from May 2003, but some countries began already in January 2003. France and the UK began asking the questions in January 2004. The only two countries for which the surveys do not include the questions are the Netherlands, who stopped asking the questions in July 2005 and Hungary that has not yet included the questions in their survey. Because all data have not yet been processed such that they can be readily used, we only use data from 18 countries in this study. 12 countries are members of the euro area, and 6 have yet to fulfil the conditions for adopting the euro or have chosen not to participate.¹

The quantitative price questions (labelled Q51 and Q61 in the harmonised questionnaire) are based on the individual responses to the qualitative price questions (labelled Q5 and Q6 in the harmonised questionnaire). The exact phrasing of these questions and their respective possible responses are as follows:

Q5 How do you think that consumer prices have developed over the last 12 months? They have: (1) risen a lot; (2) risen moderately; (3) risen slightly; (4) stayed about the same; (5) fallen; (N) don't know

¹ Data available for the following euro-area members: Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Portugal, Slovenia, and Spain. Data available for the following non-euro area members: Czech Republic, Denmark, Poland, Slovakia, Sweden, and the United Kingdom.

Q51 If question 5 was answered by 1, 2, 3, or 5: by how many percent do you think that consumer prices have gone up/down over the past 12 months? (Please give a single figure estimate): Consumer prices have increased by.....% / decreased by.....%.

Q6 By comparison with the past 12 months, how do you expect that consumer prices will develop in the next 12 months? They will: (1) increase more rapidly; (2) increase at the same rate; (3) increase at a slower rate; (4) stay about the same; (5) fall; (N) don't know

Q61 If question 5 was answered by 1, 2, 3, or 5: by how many percent do you expect consumer prices to go up/down in the next 12 months? (Please give a single figure estimate): Consumer prices will increase by.....% / decreased by.....%.

The individual responses have been aggregated into weighted monthly country averages, which in turn have been used to form a euro-area aggregate. The weights used are supplied by the institutes conducting the surveys, and they correct for possible selection biases stemming from differences in the probability of selecting a specific household.

The data contains numerous high values of which some are very extreme (see Lindén (2006) and European Commission (2006) for a brief description). The data is trimmed applying the same procedure as implemented in the University of Michigan survey of consumer attitudes (see Curtin (1996)). Responses above +95% or below -95% are truncated to +/-95%. This truncation affects less than 0.3% of all forecasted inflation rates (892 876) and about 0.8% of all the perceived inflation rates (931 691). This trimming only marginally changes the monthly country averages, and does not influence the results in any way.

There are eight months of missing data in the beginning of the sample for France and the UK, and a five-month period of missing data in 2005 for Spain. In addition, the French institute does not conduct surveys in August, so this month is missing. To bridge these periods of missing data, a linear equation is estimated for each country by regressing the available quantitative responses on the qualitative ones, as summarised by the balance statistic. The equation is then used to rescale the balance series to form a quantitative inflation sentiment for the missing months.

4. Empirical results

Preliminary tests for 18 EU Member States indicate that the expected pattern for inflationary expectations holds roughly for a small set of countries. In total eight countries show a U-shaped pattern for the forecast errors (see Table 2, column 7), six that are euro-area members and two that are not part of the euro area. The average forecast horizon for respondents in these countries is around 13 months (Table 2, columns 2 and 5 show at what lead or lag the minimum forecast error is reached).

If we expand the search for a minimum forecast error outside the pre-specified window of leading forecasts (0 to +24 months) to a lead-lag window between -12 and +12 months, three more countries show a U-shaped pattern: Denmark, France, and Slovakia. For these countries the minimum forecast error is reached at a lead or lag between +2 and -3 months. Thus, inflation forecasts are actually not forecasts, but contemporaneous estimates of past inflation. Changing the window further towards lagging expectations, covering the interval between -18 to +6 months, Italy and Sweden also shows a U-shaped pattern with minimum forecast errors at a lag of -13 and -4 months, respectively. In total, 13 out of 18 countries show the expected shape, but not at the expected lead of 12 months.

For the eight countries with U-shapes with a minimum at the correct horizon, the inflation forecasts improve by an average 0.6 of a percentage point within the lead-lag interval 0 to +24 months. The forecast improvement, or the change in the RMSE, is calculated as the difference between the maximum and the minimum error within the 25 month interval (see Table 2, column 3 and 6). The average does not change when we include the other five countries as well.

There seems to be no relationship between the number of countries that show a U-shaped forecast error and the historical inflation rate. Table 1 presents the inflation history of all EU countries, ranked in an order of increasing average inflation between 2003 and 2007. The results in Table 2 and 3 are also presented in the same order. For inflation expectations there are as many U-shapes for high-inflation countries as there are for low-inflation countries. Furthermore, there seems to be no difference between euro-area members and non-members.

With the inclusion of more countries outside the euro area, this finding might change, especially if the lead-lag window is allowed to vary outside the 0 to +24 months.

We observe that the forecast error is an increasing function of the historical inflation rate. Respondents in countries with relatively high inflation rates, make bigger forecast errors than people in low inflation countries. If the sample is divided in two equally sized groups, based on their past inflation, the group of high inflation countries has an average RMSE of 6.3 percentage points, while that of the low inflation group is 2.3 percentage points.

Inflation perceptions are a different matter. First, there are big differences between the two different measures of forecast errors. As the mean error does not actually have to produce a U-shaped pattern, because negative and positive errors can either offset each other or dominate in any direction, we only consider the RMSEs in the analysis of perceptions. Second, within in the pre-specified lead-lag window of -12 to +12 months, we find much fewer U-shapes for the backcast errors. In total there are four countries with U-shapes, but only one that is a member of the euro area, France (see Table 3, column 7). At a lag close to 0, thus in line with our presumption, the perceived inflation rate for these four countries more or less coincide with the contemporaneous actual inflation rate.

If the lead-lag window is changed to incorporate a contemporaneous forecast to a lead of 24 months for the perceived inflation rate, six euro-area member states and one non-member (Czech Republic) show a U-shaped pattern for the RMSEs. The euro-area members that become U-shaped are the same as those for expected inflation (Germany, Austria, Belgium, Luxembourg, and Spain). The minimum error is reached at an average lead of +14 months for these six countries, and thus the perceived inflation rate is rather a forecast than a recollection of past price developments. Italy and Sweden can also be added to the list when the window is changed to incorporate the lagging months -24 to 0, but in this case perceived inflation is lagging by 15 and 9 months, respectively.

These results suggest that the lead-lag behaviour of the errors made when determining past or future inflation is more related to the country than to the questions asked. Countries with leading expectations also have leading perception at a similar forecast horizon as expectations. The same is also true for countries with lagging expectations.

As for expectations, there is no relationship between the actual inflation rate and the shape of the errors of perceived inflation, and the magnitudes of the changes in the RMSEs are similar to those for expectations. Furthermore, the errors that respondents make are related to the past inflation history of the country. Respondents residing in countries with relatively high past inflation make bigger errors than respondents in countries with lower inflation.

5. Conclusions

The standard way today to obtain measures of inflationary expectations is to turn to a representative group of respondents and ask them, using questionnaires, about their beliefs of the future rate of inflation during the coming 12 months. This type of data on inflationary expectations as well as on inflationary perceptions has been collected in a unified way on an EU-wide basis for several years. By now, probably the largest database on inflationary expectations has been built up in this way.

We use this database to explore the forecasting horizons implicitly used by the respondents to questions about the expected rate of inflation during the coming 12 months in all EU member states that have supplied DG ECFIN with relevant data. We examine the forecast error using mean errors and RMSE. If the forecast horizon is truly 12 months, we expect a U-shaped pattern for the forecast error reaching its lowest value at the 12-month horizon. We also study the backcast error for inflationary perceptions in a similar way.

Our results show large differences across countries. For several countries, we get the expected outcome, for others this is not the case. Furthermore the horizon implicitly used by respondents is not related to the questions as such, but to country. When respondents have a 12-month forecast horizon for their expectations, their perceptions are also forward looking with similar leading properties. This is also true for lagging and contemporaneous expectations.

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Tables and Charts

Chart 1: Stylised illustration of expected results

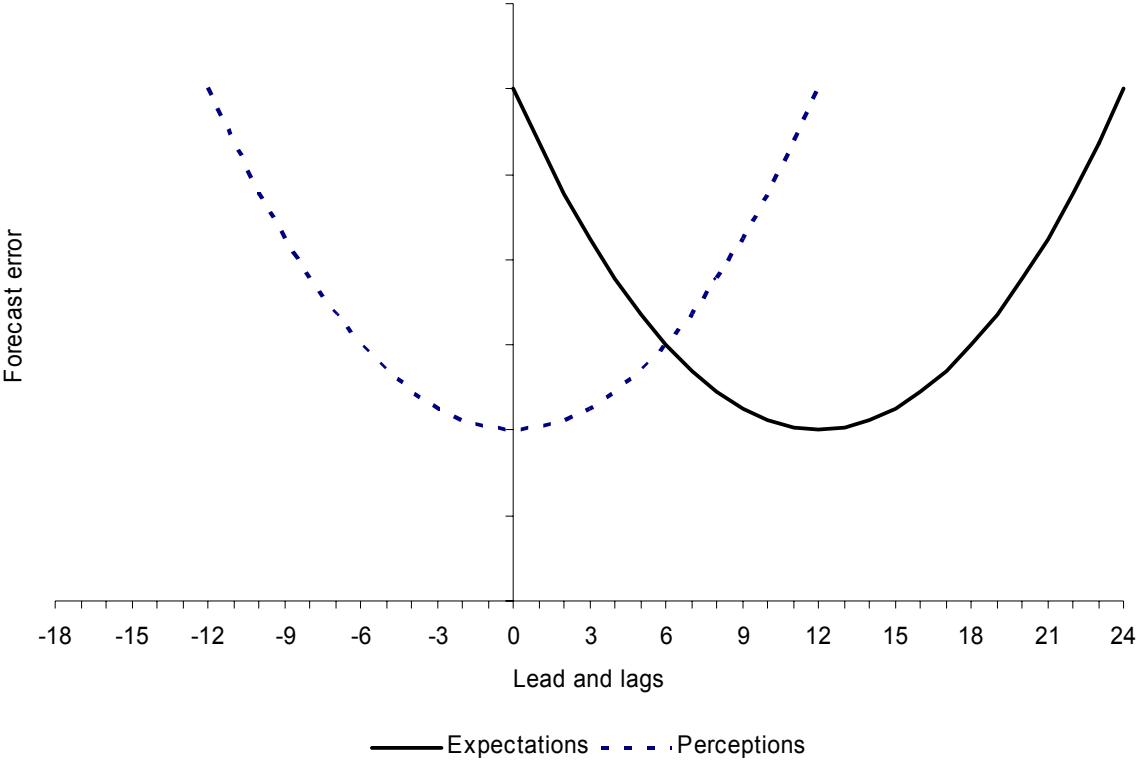


Table 1: Inflation history 1987-2007 and year for adopting the euro. Countries are ordered according to average inflation 2003 – 2007.

Inflation History							
	Jan 1987 – Dec 1996		Jan 1997 – Mar 2007		May 2003 – Jan 2007		Member
EA members	Mean (1)	Std (2)	Mean (3)	Std (4)	Mean (5)	Std (6)	Year (7)
Finland	3.4	2.14	1.5	0.86	0.8	0.55	1999
The Netherlands	1.9	1.35	2.3	1.18	1.6	0.31	1999
Germany	2.7	1.56	1.4	0.59	1.7	0.50	1999
Austria	2.7	0.87	1.6	0.62	1.8	0.47	1999
France	2.6	0.72	1.6	0.64	2.0	0.35	1999
Belgium	2.4	0.82	1.8	0.75	2.1	0.53	1999
Italy	4.9	0.90	2.2	0.40	2.3	0.27	1999
Ireland	2.7	0.88	3.1	1.29	2.6	0.58	1999
Portugal	8.4	3.40	2.8	0.90	2.6	0.61	1999
Luxembourg	1.3	0.20	2.4	1.18	3.1	0.91	1999
Spain	5.3	1.08	2.9	0.77	3.2	0.53	1999
Greece	14.2	4.14	3.5	0.97	3.3	0.31	2001
Slovenia	-	-	6.0	2.54	3.3	1.20	2007
Euro area	2.7	0.43	1.9	0.50	2.1	0.26	

	Jan 1987 – Dec 1996		Jan 1997 – Mar 2007		May 2003 – Jan 2007	
Non EA members	Mean (1)	Std (2)	Mean (3)	Std (4)	Mean (5)	Std (6)
Sweden	4.8	3.17	1.5	0.80	1.3	0.56
Denmark	2.8	1.21	1.9	0.62	1.5	0.53
Czech Republic	-	-	3.5	3.10	1.7	0.95
United Kingdom	4.2	2.17	1.6	0.54	1.8	0.52
Lithuania	-	-	2.8	3.24	2.0	1.92
Poland	-	-	5.7	4.82	2.1	1.34
Cyprus	4.1	1.58	2.6	1.35	2.3	0.92
Malta	-	-	2.7	1.08	2.5	0.75
Estonia	26.3	5.54	4.8	2.60	3.4	1.54
Hungary	23.3	4.05	8.6	4.63	4.9	1.72
Slovakia	-	-	6.7	3.44	5.5	2.50
Bulgaria	141.7	146.89	132.4	410.07	6.0	1.97
Latvia	26.3	8.30	4.6	2.45	6.0	1.50
Romania	142.0	98.65	39.2	43.42	10.1	3.23
European Union	-	-	1.9	0.41	2.1	0.23

Table 2: Expected inflation 2003 – 2007, lead 0 to +24 months.

EA members	Mean Error			Root Mean Square Error				Obs (8)
	Min (1)	Lead/Lag (2)	Change (3)	Min (4)	Lead/Lag (5)	Change (6)	Shape (7)	
Finland	1.0	24	0.7	1.0	24	0.7	\	26
The Netherlands								26
Germany	4.3	13	0.5	4.5	13	0.5	U	26
Austria	3.3	12	0.3	3.4	12	0.3	U	26
France ¹	1.0	3	0.4	1.0	4	0.4	/	26
Belgium	1.0	14	0.6	1.1	14	0.5	U	26
Italy ²	3.4	0	0.2	3.5	0	0.2	/	26
Ireland	5.7	0	0.4	5.8	0	0.4	∩	26
Portugal	5.9	24	0.3	6.0	24	0.3	∩	26
Luxembourg	1.1	13	0.8	1.3	11	0.9	U	26
Spain	9.6	14	0.5	9.7	14	0.5	U	26
Greece	9.6	17	0.2	9.8	17	0.2	U	26
Slovenia	3.8	0	1.4	3.9	0	1.6	/	26
Euro area	4.1	12	0.2	4.2	12	0.2	U	26
Non EA members	Mean Error			Root Mean Square Error				Obs
	Min	Lead/Lag	Change	Min	Lead/Lag	Change	Shape	
Sweden ²	0.8	24	0.4	1	0	0.3	∩	26
Denmark ¹	-0.2	23	0.7	0.5	22	0.4	∩	26
Czech Republic	7.1	12	0.6	7.6	8	0.6	U	26
United Kingdom	2.8	24	0.9	2.9	24	0.9	\	26
Lithuania								26
Poland	8.8	5	1.2	9	5	1.6	U	26
Cyprus								26
Malta								26
Estonia								26
Hungary								26
Slovakia ¹	8.7	0	3.5	8.9	0	3.9	/	26
Bulgaria								26
Latvia								26
Romania								26
European Union								26

- (1) France, Denmark and Slovakia are U-shaped in the lead-lag interval -12 - +12, with minimum RMSEs at lags between -3 - +2.
- (2) Italy and Sweden are U-shaped in the lead-lag interval -18 - +6, with minimum RMSEs at lags -13 and -4, respectively.

Table 3 Perceived inflation 2003 – 2007, lead -12 to +12 months.

EA members	Mean Error			Root Mean Square Error				Obs (8)
	Min (1)	Lead/Lag (2)	Change (3)	Min (4)	Lead/Lag (5)	Change (6)	Shape (7)	
Finland	2.2	-12	0.2	2.2	12	0.1	∩	38
The Netherlands								38
Germany ¹	9.3	12	0.5	10	12	6	\	38
Austria ¹	7.9	12	0.3	7.9	12	0.3	\	38
France	5.0	-5	0.2	5.1	2	0.2	U	38
Belgium ¹	5.7	11	0.6	5.8	10	0.5	\	38
Italy ²	22.7	-12	0.3	23.6	-9	0.3	/	38
Ireland	10.3	-12	0.9	10.5	-12	0.9	∩	38
Portugal	6.9	-12	0.4	6.9	-12	0.5	∩	38
Luxembourg ¹	5.3	3	0.5	5.4	11	0.5	\	38
Spain ¹	20.0	3	0.1	20.2	11	0.1	∩	38
Greece	16.6	-9	0.1	17.0	-9	0.2	∩	38
Slovenia	4.2	-12	2.1	4.3	-12	2.2	/	38
Euro area	12.0	2	0.1	12.4	11	0.1	\	38

Non EA members	Mean Error			Root Mean Square Error				Obs
	Min	Lead/Lag	Error	Min	Lead/Lag	Error	Shape	
Sweden ²	0.3	-12	0.3	0.7	-10	0.3	/	38
Denmark	-0.1	-9	0.2	0.4	0	0.3	U	38
Czech Republic ¹	2.7	12	1	3.2	3	1	\	38
United Kingdom	3.4	12	0.7	3.6	12	0.7	\	38
Lithuania								38
Poland	8.8	12	0.3	9.4	0	0.6	U	38
Cyprus								38
Malta								38
Estonia								38
Hungary								38
Slovakia	7.7	-4	2.1	7.8	-4	2.3	U	38
Bulgaria								38
Latvia								38
Romania								38
European Union								38

- (1) Germany, Austria, Belgium, Luxembourg, Spain, Czech Republic, and the euro area as a whole are U-shaped or level out in the leading interval 0 - +24, with minimum RMSEs at leads between +12 - +21.
- (2) Italy and Sweden are U-shaped between the lags -24 – 0 with minimum RMSEs at lags between -15 to -10.

Chart 2a: Mean error for the expected inflation rate in relation to the actual inflation rate, series are shifted between 0 months (contemporaneous) and +24 months (leading)

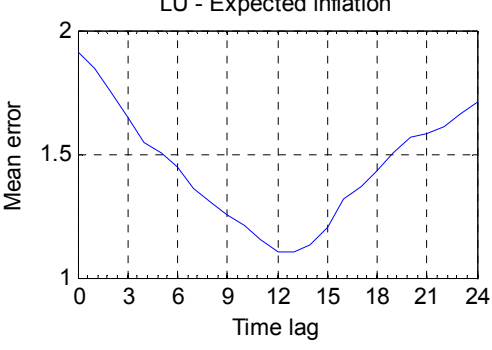
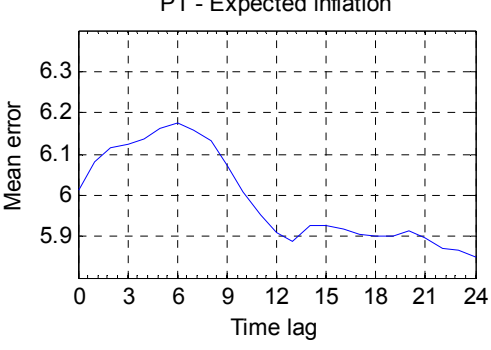
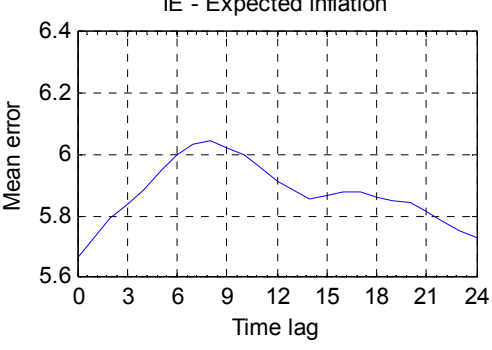
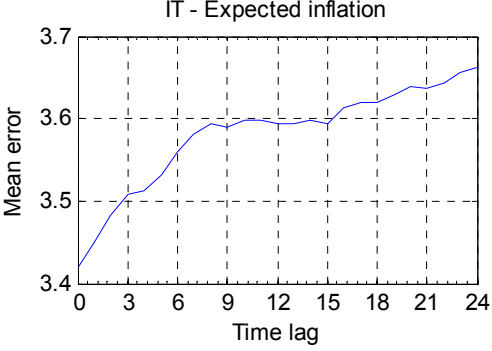
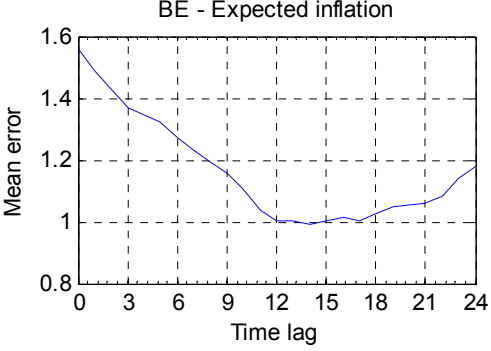
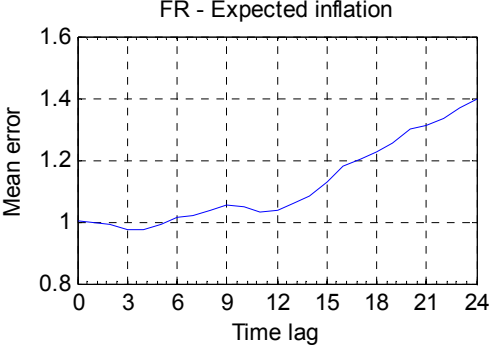
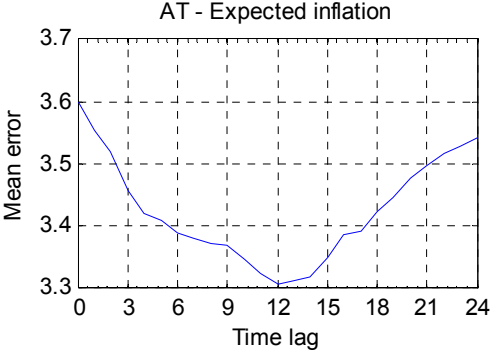
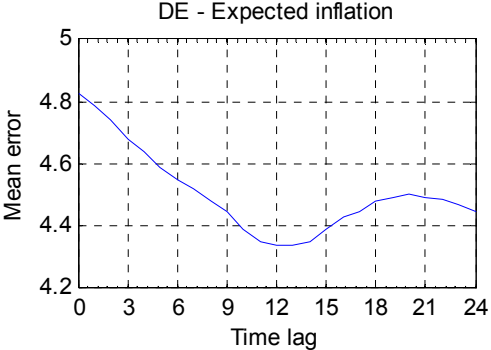
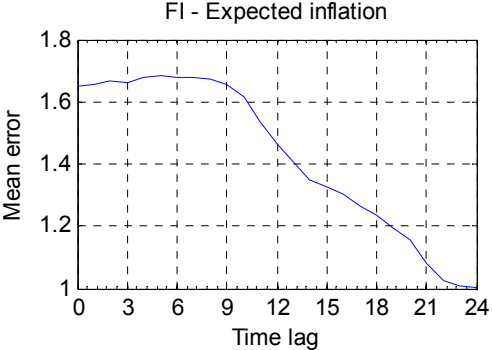


Chart 2b: Mean error for the expected inflation rate in relation to the actual inflation rate, series are shifted between 0 months (contemporaneous) and +24 months (leading)

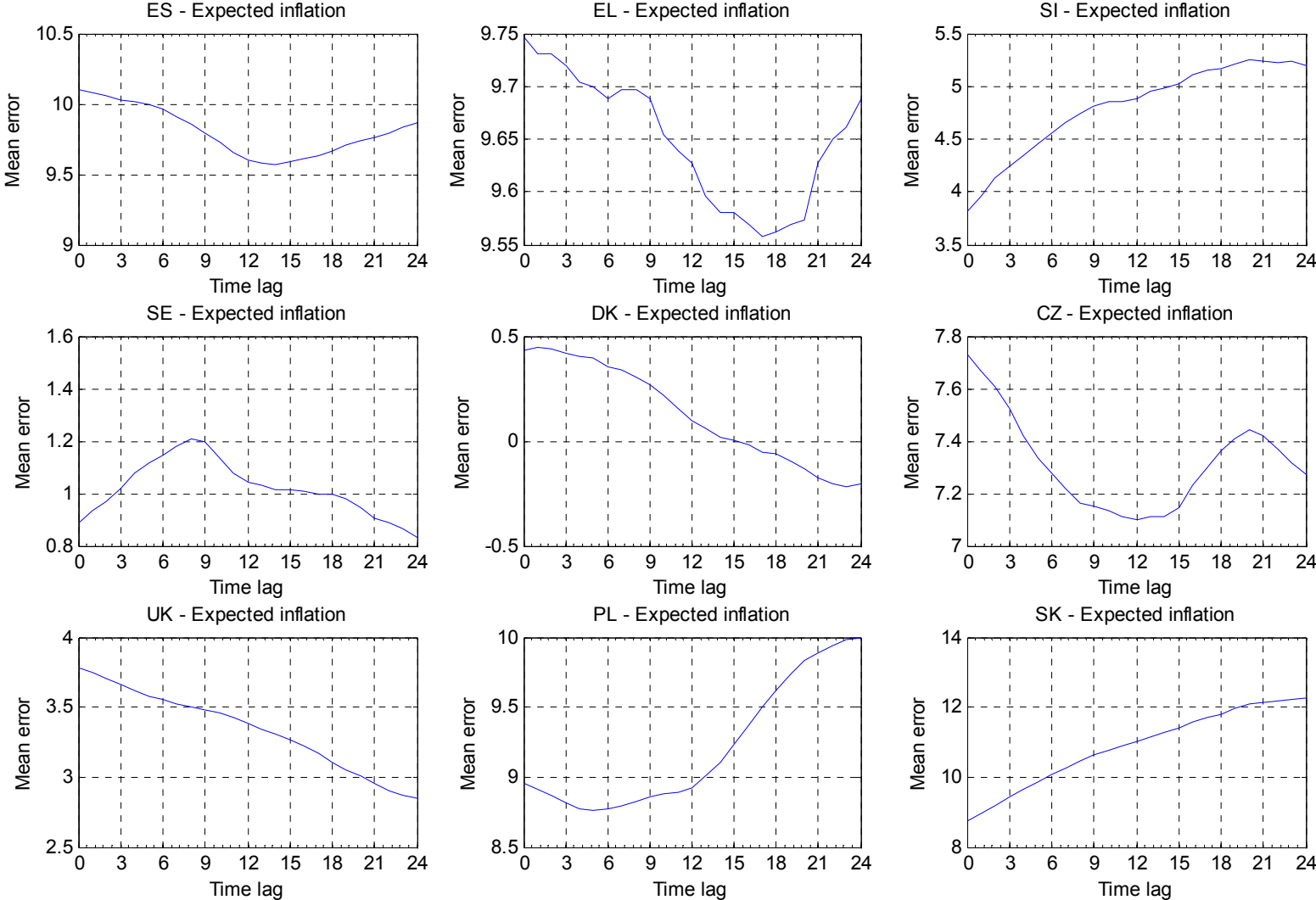


Chart 3a: Root mean square error for the expected inflation rate in relation to the actual inflation rate, series are shifted between 0 months (contemporaneous) and +24 months (leading)

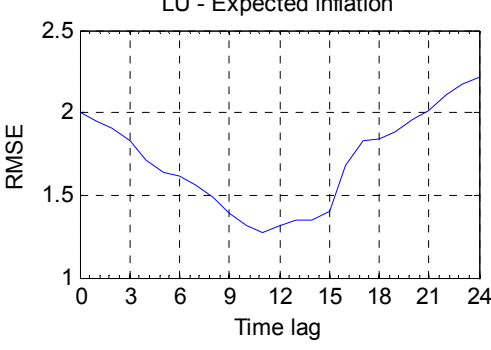
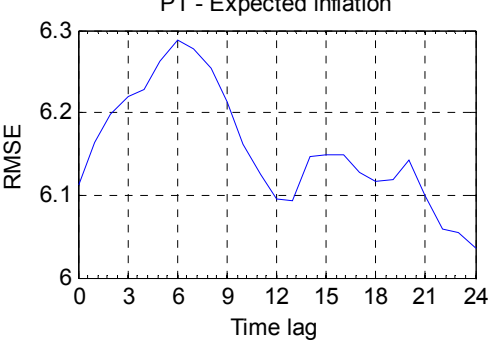
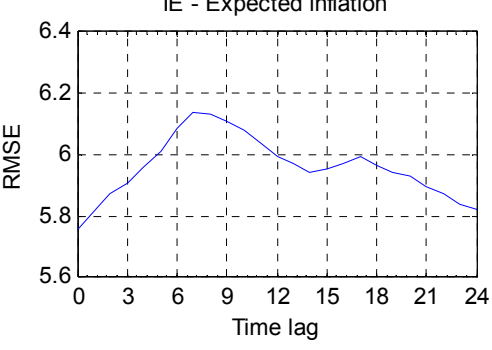
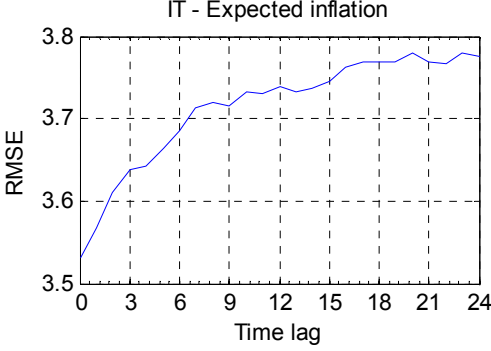
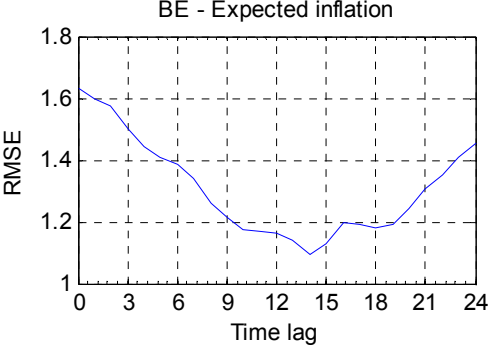
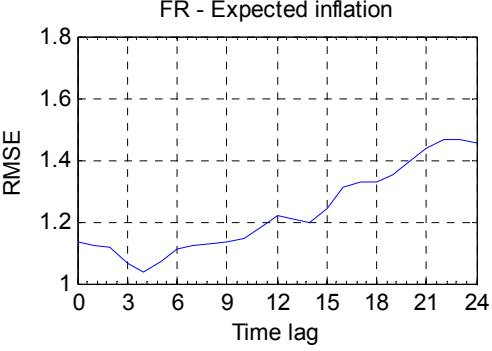
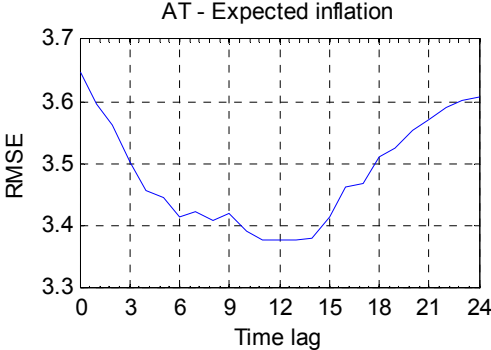
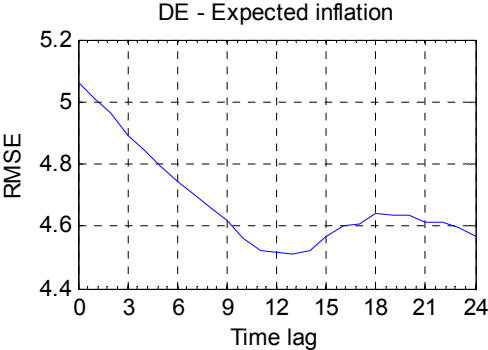
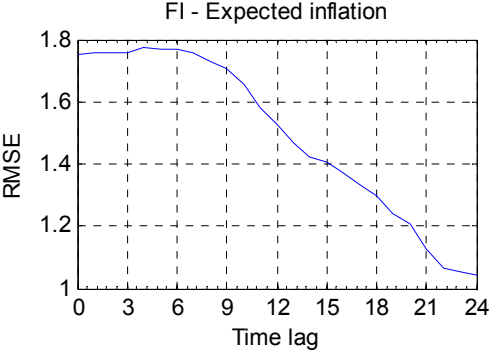


Chart 3b: Root mean square error for the expected inflation rate in relation to the actual inflation rate, series are shifted between 0 months (contemporaneous) and +24 months (leading)

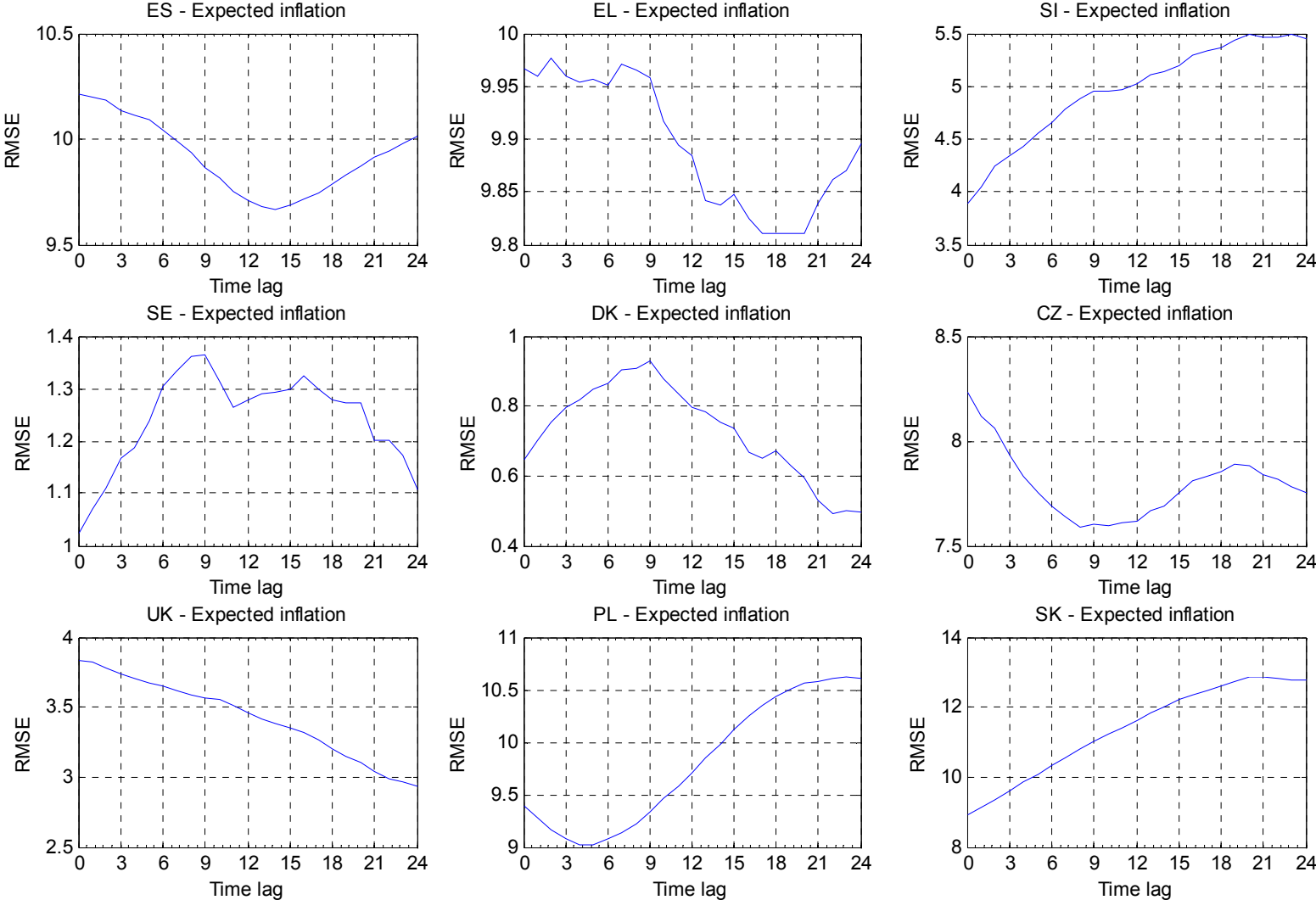


Chart 4a: Mean error for the perceived inflation rate in relation to the actual inflation rate, series are shifted between -12 months (lagging) and +12 months (leading)

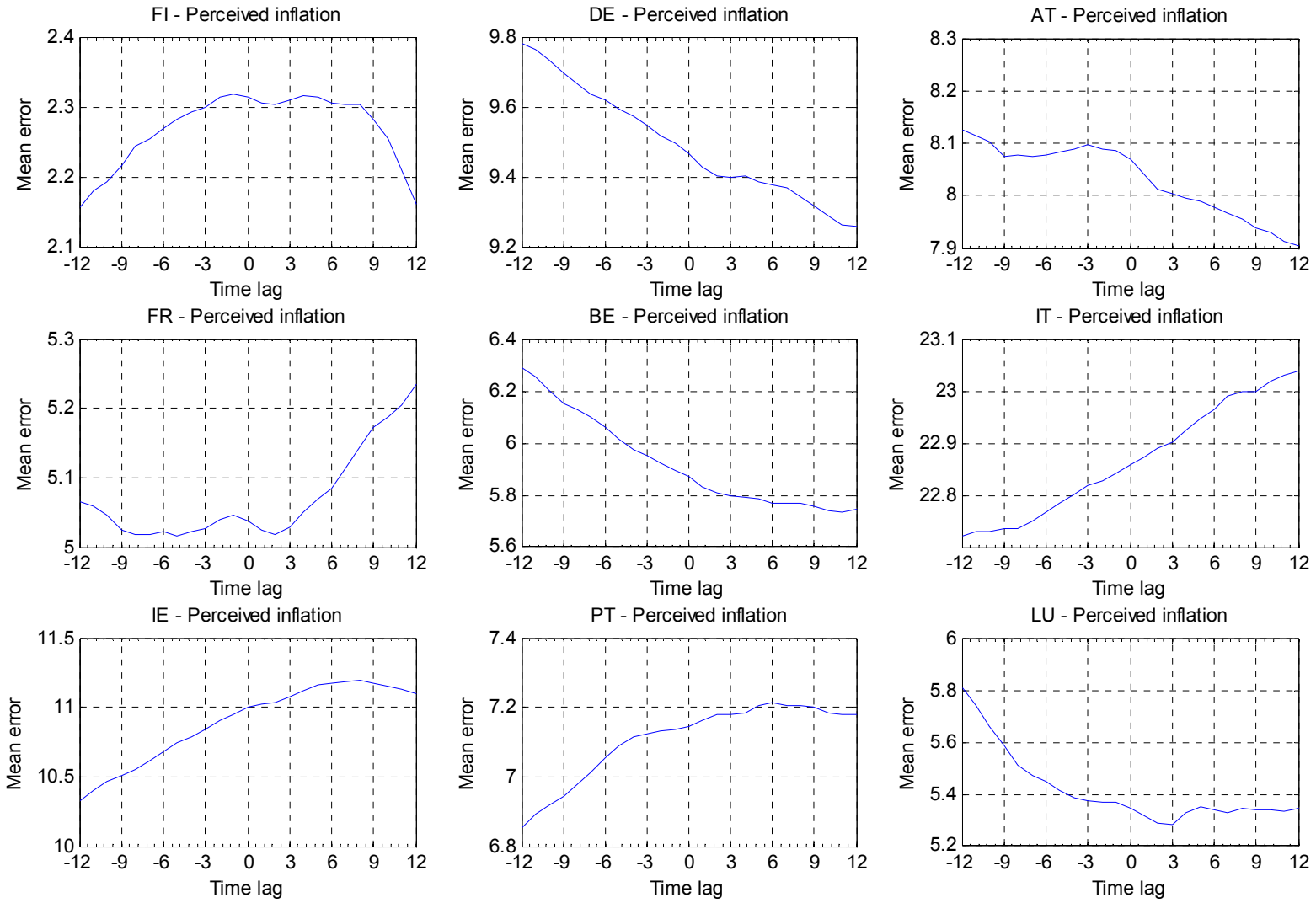


Chart 4b: Mean error for the perceived inflation rate in relation to the actual inflation rate, series are shifted between -12 months (lagging) and +12 months (leading)

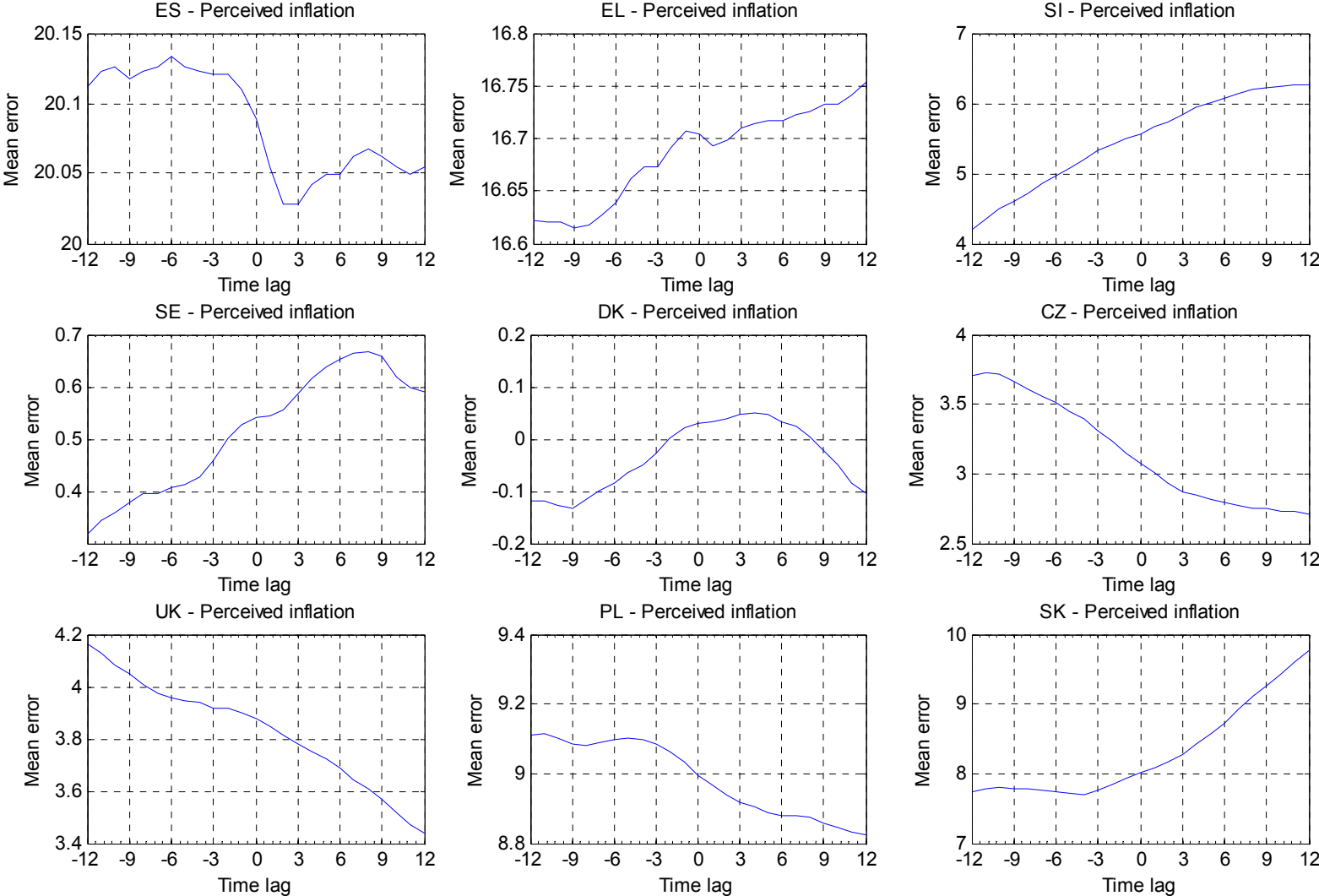


Chart 5a: Root mean square error for the perceived inflation rate in relation to the actual inflation rate, series are shifted between -12 months (lagging) and +12 months (leading)

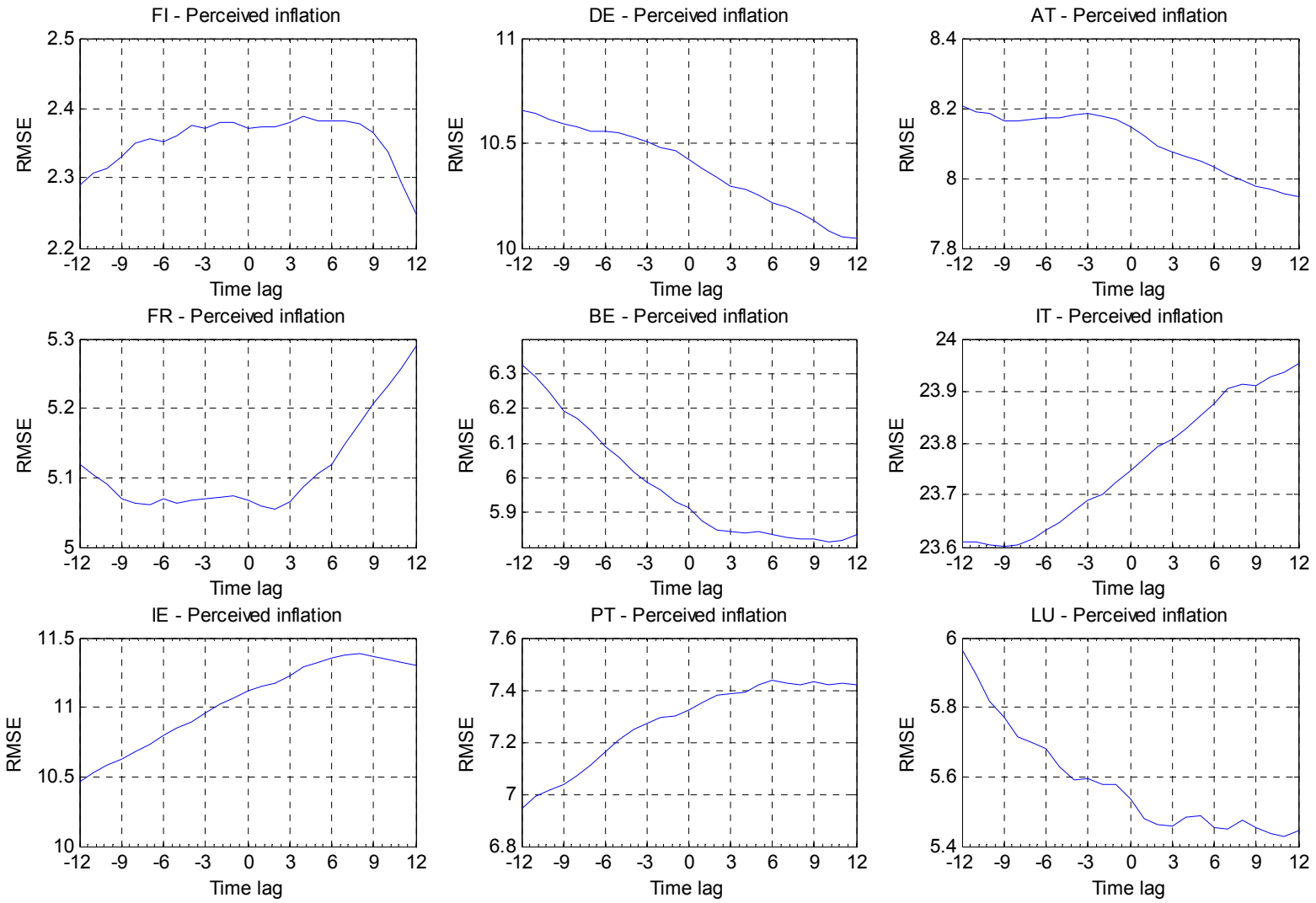


Chart 5b: Root mean square error for the perceived inflation rate in relation to the actual inflation rate, series are shifted between -12 months (lagging) and +12 months (leading)

