

Consumer Inflation Expectations in Europe: Some Cross-country Comparisons*

Oczekiwania inflacyjne konsumentów w Europie – analiza porównawcza

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Abstract

The aim of our study is to analyse selected features of consumers' inflation expectations in European countries. After assessing reliability of survey measures of inflation expectations available we use the measures fulfilling our requirements to examine three features of inflation expectations, i.e. their forecasting accuracy, causality between inflation expectations and actual future inflation and the long-run convergence of expectations to the actual future inflation. The forecasting accuracy of quantified measures of inflation expectations is rather poor and similar to naive forecasts. Even if they provide biased predictors of future inflation, there exists causality between actual future inflation and current expectations. Our analysis may be useful in selecting adequate measures of consumer inflation expectations embodying information important in monetary policy making.

Keywords: inflation expectations, survey, rationality

JEL: D12, D84, E58

Streszczenie

Celem pracy jest przeanalizowanie wybranych cech oczekiwań inflacyjnych konsumentów w krajach europejskich. Po dokonaniu oceny wiarygodności różnych ankietowych miar oczekiwań inflacyjnych wskaźniki uznane za wiarygodne zostały wykorzystane do przetestowania trzech cech oczekiwań inflacyjnych, tj. ich własności prognostycznych, przyczynowości między oczekiwaniami a przyszłą inflacją oraz długookresowej zależności między przyszłą inflacją a oczekiwaniami. Własności prognostyczne skwantyfikowanych miar oczekiwań inflacyjnych są raczej słabe, podobne do prognoz naiwnych. Mimo że miary te są obciążonymi predyktorami przyszłej inflacji, istnieje przyczynowość między przyszłą inflacją a bieżącymi oczekiwaniami. Wyniki naszej analizy mogą być użyteczne przy wyborze miar oczekiwań inflacyjnych o stosunkowo największej zawartości informacyjnej istotnej w prowadzeniu polityki pieniężnej.

Słowa kluczowe: oczekiwania inflacyjne, ankiety, racjonalność

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1. Introduction

This paper follows several studies examining consumers' inflation expectations in Poland. So far we have developed measurement methods of Polish consumers' expectations based on survey data (e.g. Łyziak, Stanisławska 2006a), analyzed formation process of inflation expectations, especially in the context of the credibility of inflation targets (Łyziak 2005; Łyziak et al. 2006), as well as used these measures in modelling inflation (Kokoszcyński et al. 2006). While evaluating the rationality of Polish consumers' inflation expectations, we have compared various features of expectations of this group of agents with features of analogous expectations in the euro area (Łyziak 2003) and in the Czech Republic (Kokoszcyński et al. 2006).

The aim of this study is to deepen the understanding of the formation process of consumers' inflation expectations by conducting cross-country comparisons and by using a wide set of indicators of consumer inflation expectations in European economies. The paper is focused on two issues. Firstly, we develop the analytical framework for assessing the reliability of various measures of consumer inflation expectations (i.e. probability measures quantified on the basis of qualitative survey data, measures derived from quantitative survey question, balance statistics describing the distribution of responses to the qualitative survey question). Secondly, using measures classified as reliable we examine their three features, namely forecasting accuracy, causality between the actual future inflation and expectations as well as their long-run convergence to the actual future inflation with respect to which they are formed.

Various features of European consumers' inflation expectations have been already analysed in the literature, however, these works focused on the euro area (Forsells, Kenny 2004; Mestre 2007) or on selected member states of the European Union (Berk 2000; Berk, Hebbink 2006; Forsells, Kenny 2006; Döpke et al. 2006). The novelty of our study lies in its completeness: we analyse cases of 27 economies and the euro area as a whole using various measures of consumers' inflation expectations. The paper follows our previous study on European consumers' inflation expectations (Łyziak, Stanisławska 2006b), in which we examined the impact of current inflation on inflation expectations – a problem directly related to the credibility of monetary policy conducted by central banks.¹

This paper is organised as follows: Section 2 presents various survey measures of consumer inflation expectations in European economies and verifies their reliability. Section 3 describes selected features of consumer inflation expectations resulting from empirical tests conducted. The final section offers our conclusions.

¹ Limited sensitivity of inflation expectations to changes in the current inflation constitutes one of the conditions of anchoring inflation expectations (Berk 2006).

2. Survey measures of consumers' inflation expectations and their reliability

In this study we employ various measures of European consumers' inflation expectations, obtained from surveys designed both in a qualitative and quantitative manner. Such variety of sources and indices allows us to assess, apart from cross-country differences, the sensitivity of outcomes to the measurement method.

In the first place we analyze measures derived from qualitative surveys in which respondents declare the expected direction and intensity of price changes during the next 12 months, without providing exact numbers. The data source is the Consumer Survey conducted by the European Commission², which covers all the EU countries, although with samples starting at different points of time.³ The survey question is formulated in the following way: „By comparison with the past 12 months, how do you expect that consumer prices will develop in the next 12 months? They will: increase more rapidly (a_1); increase at the same rate (a_2); increase at a slower rate (a_3); stay about the same (b); fall (c); don't know (d)”.⁴ For Poland we employ an additional survey – carried by Ipsos – which has a similar construction but covers a longer period (since 1992). The survey data is then quantified with the probability method, in order to obtain the so-called objectified and subjectified measures of inflation expectations.⁵ In line with the logic of the survey question, the resulting measures of expected inflation are a function of the structure of responses to the survey question and the perception of current inflation (scaling factor), to which respondents compare anticipated price changes.

In the case of the objectified measure it is assumed that respondents perceive current price movements through official inflation statistics, thus the most recently published consumer price index is used as the current inflation rate. Another solution is to use an index of subjective inflation perception, which can be obtained from an additional survey question on current price level in comparison to the price level a year before. Such a question is included in the European Commission Consumer Survey and has the following form: “In your opinion, is the price level now compared to that twelve months ago: much higher (a_1^p); moderately higher (a_2^p); a little higher (a_3^p); about the same (b^p); lower (c^p); difficult

² More details about the survey can be found in EC (2007).

³ The longest survey started in January 1985. However, in order to operate on samples of comparable length, all observations before January 1995 were omitted. For most of new member states of the European Union the samples start in 2001.

⁴ Symbols in parentheses denote fractions of respondents choosing subsequent response categories.

⁵ The probability quantification method used to obtain measures of consumer inflation expectations analysed in this study is based on approaches by Batchelor and Orr (1988), Berk (1999), Forsells and Kenny (2004) and described in detail *inter alia* in Łyziak (2005) and Łyziak, Stanisławska (2006a).

to say $(d^p)^6$. Inflation expectations' measure calculated in this way is called subjectified.

Quantification results show that both versions of the probability method provide similar approximations of consumer inflation expectations in a major part of European economies. Measuring the dispersion of our estimates we calculate average absolute differences between subjectified and objectified measures of inflation expectations, expressing them as a percent of average inflation. Such indicator is lower than 10% in the case of 13 economies, including: France, the Czech Republic, Belgium, United Kingdom, Germany, the Netherlands, Sweden, Latvia, Ireland, Luxembourg, Poland, Denmark and the Economic and Monetary Union (EMU) as a whole. In Hungary, Italy, Portugal, Cyprus and Slovakia our measurement uncertainty indicator exceeds 10% only slightly. The remaining economies are characterized by more significant ambiguity in measuring inflation expectations with the wedge between both probability measures equal approximately 15–20% of average inflation in Spain and Romania, 20–30% in Estonia, Bulgaria, Slovenia and Finland, and more than 30% in Malta, Greece, Lithuania. The dispersion indicator for Austria reaches its maximum of 51.5%.

In our analysis we additionally refer to balance statistics, defined as differences between (weighted or unweighted) proportions of respondents to the survey question. Admittedly, they do not measure inflation expectations directly, but at the same time they are not influenced by the assumptions imposed in quantification methods. In our study we use balance statistics both of consumer inflation expectations and inflation perception. The latter ones are needed to assess the reliability of quantified measures of inflation expectations. Five balance statistics are employed. The first two are unweighted statistics: BS_1 (BS_1^p) is a difference between proportions of respondents expecting (noticing) increase in prices and their decrease, i.e.:

$$BS_1 = a_1 + a_2 + a_3 - c, \quad BS_1^p = a_1^p + a_2^p + a_3^p - c^p \quad (1)$$

while BS_2 (BS_2^p) is a difference between proportions of respondents expecting (noticing) increase in prices and their stabilisation or decrease, i.e.:

$$BS_2 = a_1 + a_2 + a_3 - b - c, \quad BS_2^p = a_1^p + a_2^p + a_3^p - b^p - c^p \quad (2)$$

The third balance statistics, BS_3 (BS_3^p), is a weighted one frequently used (e.g. Del Giovane, Sabbatini 2004, 2005; ECB 2002; 2003; 2005), attaching weight 1 to the proportion of respondents expecting prices to increase at faster rate (perceiving that the prices now are much higher than twelve months ago), $\frac{1}{2}$ to those claiming

that prices will increase at the same rate (are moderately higher), 0 to those declaring that prices will decrease at slower rate (are a little higher), $-\frac{1}{2}$ to the fraction of respondents expecting (declaring) stabilisation of prices and -1 to those expecting (noticing) their fall:

$$BS_3 = a_1 + \frac{1}{2}a_2 - \frac{1}{2}b - c, \quad BS_3^p = a_1^p + \frac{1}{2}a_2^p - \frac{1}{2}b^p - c^p \quad (3)$$

The fourth balance statistics, BS_4 (BS_4^p), is similar to the BS_3 (BS_3^p), but replaces its weights: 1, $\frac{1}{2}$, 0, $-\frac{1}{2}$, -1 with the following ones: 3, 2, 1, 0, -1, i.e.:

$$BS_4 = 3a_1 + 2a_2 + a_3 - c, \quad BS_4^p = 3a_1^p + 2a_2^p + a_3^p - c^p \quad (4)$$

The fifth balance statistics, BS_5 (BS_5^p) – so-called $\Phi(\Phi^p)$ statistics – summarizes the survey results in the way consistent with the normal distribution of the expected (perceived) inflation, as assumed in the probability quantification procedure. This indicator reflects the impact of the changes in the structure of responses to the survey question on the quantified measures of inflation expectations (perception) assuming a constant current rate of inflation (a range of implied perceived price changes of the respondents claiming that prices are about the same relative to its level twelve months ago).⁷ In the case of inflation expectations the statistic is given by the formula:

$$BS_5 = \frac{Nz^{-1}\left(1 - \sum_{k=1}^3 a_k\right) + Nz^{-1}(c)}{Nz^{-1}\left(1 - \sum_{k=1}^3 a_k\right) + Nz^{-1}(c) - Nz^{-1}(1 - a_1) - Nz^{-1}\left(1 - \sum_{k=1}^2 a_k\right)} \quad (5)$$

while in the case of inflation perception by the following one:

$$BS_5^p = \frac{Nz^{-1}\left(1 - \sum_{k=1}^3 a_k^p\right) + Nz^{-1}(c^p)}{Nz^{-1}\left(1 - \sum_{k=1}^3 a_k^p\right) - Nz^{-1}(c^p)} \quad (6)$$

where Nz denotes the standardized normal cumulative distribution function.

Due to limitations of quantification procedures, which appear under specific distributions of responses to the survey question, some of the quantified inflation expectations measures may be less reliable than the other ones. Therefore, before moving to analysis of the formation of consumer inflation expectations in European economies, we assess the reliability of their proxies generated within different quantification algorithms. We apply a set of criteria (Table 1).⁸

Objectified probability measures of inflation expectations are treated as trustworthy if the survey data on inflation perception – summarized by more or less

⁷ See Lyziak (2005) or Lyziak, Stanisławska (2006a) for details.

⁸ It should be stressed that the choice of cut-off points in the application of the proposed criteria is arbitrary and easy to contest.

⁶ Symbols in parentheses denote fractions of respondents choosing subsequent response categories.

Table 1. *Usefulness of probability measures of inflation expectations*

Country [sample]	Measurement uncertainty ¹	Usefulness of objectified measures of expectations		Usefulness of subjectified measures of expectations		Probability inflation expectations' indices to be used
		Spearman $BS_1^p - \pi_0$	Spearman $BS_3^p - \pi_0$	Spearman $BS_1^p - BS_3^p$	BS_3^p relative volatility to BS_1^p relative volatility, %	
Austria [1995:10–2007:01]	51.5	0.3145*	0.3079*	0.9724*	1.37	both
Belgium [1995:01–2007:01]	1.8	0.3976*	0.4575*	0.9132*	2.48	both
Bulgaria [2001:05–2007:01]	25.5	0.1893	0.1889	0.9223*	3.47	–
Cyprus [2001:05–2007:01]	11.9	-0.2719*	0.1277	0.1952	2.77	–
Czech Republic [2001:01–2007:01]	1.3	0.6932*	0.6763*	0.9761*	1.33	both
Denmark [1995:01–2007:01]	7.4	0.6836*	0.6304*	0.9964*	1.02	both
EMU [1995:01–2007:01]	9.1	0.4129*	0.4234*	0.9724*	2.09	both
Estonia [2001:04–2007:01]	25.0	0.5368*	0.2054	0.8533*	4.67	objectified
Finland [1996:07–2007:01]	27.8	0.2008*	0.1540	0.9564*	1.21	subjectified
France [1995:01–2007:01]	0.1	0.5952*	0.6057*	0.9631*	18.24	objectified
Germany [1995:01–2007:01]	4.2	0.1801*	0.2246*	0.9335*	5.96	-
Greece [1995:01–2007:01]	32.5	0.0677	-0.0099	0.7992*	2.31	subjectified
Hungary [1995:01–2007:01]	10.4	0.6896*	0.8715*	0.8081*	13.70	objectified
Ireland [1998:03–2007:01]	5.4	0.6353*	0.6019*	0.8542*	3.66	objectified
Italy [1995:01–2007:01]	10.5	0.5600*	0.4415*	0.9250*	2.19	both
Latvia [2001:05–2007:01]	5.1	0.7801*	0.8118*	0.8684*	5.82	objectified
Lithuania [2001:05–2007:01]	36.1	0.8445*	0.8479*	0.9491*	1.80	both
Luxembourg [2002:01–2007:01]	5.8	-0.128	0.0775	0.4342*	5.20	–
Malta [2002:11–2007:01]	32.0	0.1533	0.5408*	0.7894*	2.50	both
Netherlands [1995:01–2007:01]	4.4	0.6273*	0.2849*	0.9136*	3.21	objectified
Poland [2001:05–2007:01]	6.7	0.7118*	0.7321*	0.9073*	2.17	both
Portugal [1997:01–2007:01]	11.2	0.5768*	0.2505*	0.7625*	4.29	objectified
Romania [2001:05–2007:01]	19.0	0.4346*	0.6040*	0.5949*	5.06	objectified
Slovakia [2000:04–2007:01]	12.3	0.6784*	0.7199*	0.9282*	5.96	objectified
Slovenia [1996:03–2007:01]	25.7	0.0267	0.4695*	-0.0024	2.87	objectified
Spain [1995:01–2007:01]	15.0	0.3644*	0.4214*	0.9574*	3.47	objectified
Sweden [1995:10–2007:01]	4.8	0.7513*	0.7393*	0.9934*	1.00	both
United Kingdom [1995:01–2007:01]	3.1	0.3935*	0.3793*	0.7368*	1.08	both

* denotes significance at 5% level.

¹ Average absolute difference between subjectified and objectified measure of expectations relative to average inflation, in %.

Source: own calculations.

Table 2. Transformation formulas of expectations measures based on surveys with quantitative questions in Poland and Hungary

Country [sample]	α	β	R^2
Poland [2003:05–2007:01]	-1.390 (0.576)	0.301 (0.056)	0.58
Hungary [2000Q01–2006Q04]	-6.494 (0.861)	0.702 (0.047)	0.86

Newey-West standard error in parentheses.

Source: own calculations.

aggregated balance statistics, such as BS_1^P or BS_3^P – is correlated with official indicators of price dynamics. If it was not true, it would be difficult to argue that consumers' perception of current price movements is in line with official inflation numbers. In the context of our study, this condition is satisfied in Austria, Belgium, the Czech Republic, Denmark, EMU as a whole, Estonia, France, Hungary, Ireland, Italy, Latvia, Lithuania, Malta, the Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and the United Kingdom.

The reliability of subjectified measures of inflation expectations is evaluated comparing balance statistic describing the patterns of responses to the survey question on inflation perception consistently with the normal-distribution-based quantification method (i.e. BS_5^P) with a more intuitive figure calculated as a difference between the fraction of respondents declaring a perceived increase in prices and their decrease (i.e. BS_1^P). If significant differences between both measures occur, it suggests that changes in the quantified perceived inflation may be unintuitive with respect to the scale of changes in patterns of responses to the survey question and introduced by imposing backward-unbiasedness condition. Correlation analysis combined with the assessment of differences in relative volatility of both balance statistics shows that subjectified measures of inflation expectations seem to be sufficiently reliable in Austria, Belgium, Czech Republic, Denmark, EMU as a whole, Finland, Greece, Italy, Lithuania, Malta, Poland, Sweden and the United Kingdom.

Surveys in which the question on future price changes is formulated in a quantitative manner, i.e. respondents are asked to give an exact number of the anticipated inflation, constitute another source of data on consumer inflation expectations. Such measures referring to a 12-month-horizon and calculated as a mean or median of individual responses, are available for Poland, Sweden, Hungary and the United Kingdom.⁹ Contrary to the EC Consumer Survey, these surveys are not harmonized and differ slightly in wording and frequency of conducting. This type of data is not affected by problems related to the quantification procedure, but

some empirical findings suggest that quantitative questions might be too difficult for consumers and therefore harm the reliability of the results.¹⁰ The problem with such measures of inflation expectations is that in some of the economies considered (namely: Poland and Hungary) they are characterized by a large bias. As the bias is present also in inflation perception, it might be suspected that it is linked to the measurement error and an analogous design of quantitative questions concerning perception and expectations may support the hypothesis that errors from both questions are closely linked to each other. Therefore, assuming that the gap between respondents' subjective perception of price movements over the previous 12 months and the current inflation measured by official statistics is fully attributable to the measurement errors, we can derive implied measurement errors related to quantitative (subjective) estimates of inflation expectations. The logic behind this transformation corresponds directly to the regression methods, which translate subjective projections into numbers consistent with official measures of inflation. In the first step, the relationship between the subjective perception of past price changes ($\pi_{s,t}^p$) and the relevant statistical indicators of past inflation (π_t^e) is examined:

$$\pi_t^e = \alpha + \beta \cdot \pi_{s,t}^p + \varepsilon_t \quad (7)$$

In the second step, assuming that the same function transforms expected price movements as subjectively reported in the survey ($\pi_{s,t}^e$) into objectified measures of consumer inflation expectations (π_t^e), the latter indicators may be quantified:

$$\pi_t^e = \hat{\alpha} + \hat{\beta} \cdot \pi_{s,t}^e \quad (8)$$

The estimation results of the equation (7) are presented in Table 2.

⁹ In the case of Poland we employ the GfK Polonia survey data, for Hungary – the survey conducted by the National Bank of Hungary, for Sweden – the survey of the National Institute of Economic Research and for the UK – the Bank of England and NOP Inflation Attitudes Survey. In November 2002 the European Commission decided to introduce on an experimental basis a quantitative question to the survey, but the data are unavailable

¹⁰ There is a rationale to believe that responses to quantitative questions involve greater uncertainty than in the case of qualitative questions (Jonung 1986). Moreover, respondents declare characteristic numbers: 0, 5, 10, 15, etc. (so called digit preference), often higher than official inflation statistics, and give answers inconsistent with their replies to qualitative questions. The problem of the reliability of quantitative survey questions, especially concerning Polish consumers, is addressed in Łyziak, Stanisławska (2006a).

3. Selected features of European consumers' inflation expectations

3.1. Forecast performance of survey measures of consumers' inflation expectations

Quantified measures of consumer inflation expectations are useful in testing the formation mechanism of expectations. In the first step we analyse the performance of

inflation expectations measures as predictors of future inflation. We are interested whether consumers' predictions of future inflation are unbiased and how accurate they are in comparison with a naive forecast i.e. forecast equal to current (known) inflation (Table 3).

In the majority of economies under consideration, consumers' absolute value of average forecast error does not exceed 2 p.p. There are few exceptions, including direct measures of inflation expectations based on qu-

Table 3. Forecast performance of inflation expectations measures

Country/measure	Individual samples					Common sample [2001:05–2007:01]			
	ME (p.p.)	MAE (p.p.)	MAPE (%)	RMSE (p.p.)	HLN-DM test stat. ¹	ME (p.p.)	MAE (p.p.)	MAPE (%)	RMSE (p.p.)
Austria									
– objectified [1995:10–2007:01]	-0.5	0.8	42.5	1.1	0.30	-0.2	0.7	36.7	0.9
– subjectified [1995:10–2007:01]	0.4	1.1	92.8	1.4	1.39	0.9	1.0	65.4	1.1
Belgium									
– objectified [1995:01–2007:01]	-0.6	0.9	52.1	1.1	1.25	-0.5	1.0	55.6	1.2
– subjectified [1995:01–2007:01]	-0.6	0.8	43.3	1.0	0.16	-0.4	0.7	37.8	0.9
Czech Republic									
– objectified [2001:01–2007:01]	0.4	2.1	348.2	2.6	0.59	0.4	2.2	372.8	2.6
– subjectified [2001:01–2007:01]	0.6	1.9	381.7	2.4	-0.42	0.6	1.9	408.7	2.5
Denmark									
– objectified [1995:01–2007:01]	-1.1	1.2	55.2	1.3	3.16**	-0.7	0.9	50.1	1.1
– subjectified [1995:01–2007:01]	-1.0	1.0	48.0	1.2	2.56*	-0.6	0.8	42.7	0.9
EMU									
– objectified [1995:01–2007:01]	-0.5	0.6	30.7	0.8	1.58	-0.7	0.7	33.0	0.8
– subjectified [1995:01–2007:01]	-0.3	0.5	24.3	0.6	0.11	-0.4	0.5	24.0	0.6
Estonia									
– objectified [2001:04–2007:01]	0.6	2.2	129.4	2.5	0.15	0.6	2.2	131.0	2.5
Finland									
– subjectified [1996:07–2007:01]	-0.1	0.9	126.3	1.1	-0.87	0.7	0.8	210.4	0.9
France									
– objectified [1995:01–2007:01]	-0.5	0.6	47.2	0.8	1.10	-0.6	0.6	30.5	0.7
Greece									
– subjectified [1995:01–2007:01]	2.0	2.2	64.9	3.1	2.76**	1.5	1.7	53.5	2.2
Hungary									
– objectified [1995:01–2007:01]	3.4	3.9	48.2	5.3	1.12	1.8	2.8	68.8	3.4
– quantitative [2000:01–2006:04] ²	12.6	12.6	266.6	12.8	-	-	-	-	-
– quantitative obj. [2000:01–2006:04] ²	0.7	1.9	38.8	2.0	-	-	-	-	-
Ireland									
– objectified [1998:03–2007:01]	-1.0	1.5	41.3	2.0	-0.18	-0.7	1.1	39.7	1.3
Italy									
– objectified [1995:01–2007:01]	-0.5	0.8	35.4	1.0	-0.27	-0.9	0.9	41.5	1.0
– subjectified [1995:01–2007:01]	-0.2	0.6	24.7	0.7	-1.01	-0.5	0.6	27.6	0.7
Latvia									
– objectified [2001:05–2007:01]	-1.0	1.5	39.2	2.0	-0.88	-1.0	1.5	39.2	2.0
Lithuania									
– objectified [2001:05–2007:01]	-0.3	1.9	150.6	2.4	-1.04	-0.3	1.9	150.6	2.4
– subjectified [2001:05–2007:01]	-0.4	2.2	151.0	2.3	-0.34	-0.4	2.2	151.0	2.3
Malta									
– objectified [2002:11–2007:01]	-1.3	1.5	60.2	1.8	4.46**	-	-	-	-
– subjectified [2002:11–2007:01]	-2.0	2.1	73.3	2.2	1.32	-	-	-	-
Netherlands									
– objectified [1995:01–2007:01]	-0.4	0.8	32.3	1.1	0.48	0.0	0.8	38.0	1.0
Poland									
– objectified [2001:05–2007:01]	0.5	2.2	191.5	2.6	-1.53	0.5	2.2	191.5	2.6
– subjectified [2001:05–2007:01]	1.0	2.0	192.2	2.3	-2.29*	1.0	2.0	192.2	2.3

Country/measure	Individual samples					Common sample [2001:05–2007:01]			
	ME (p.p.)	MAE (p.p.)	MAPE (%)	RMSE (p.p.)	HLN- DM test stat. ¹	ME (p.p.)	MAE (p.p.)	MAPE (%)	RMSE (p.p.)
– objectified (Ipsos) [1995:01–2007:01]	3.4	4.5	126.2	5.6	1.86	0.8	2.3	208.2	2.7
– quantitative [2003:05–2007:01]	9.1	9.1	693.3	9.8	–	–	–	–	–
– quantitative obj. [2003:05–2007:01]	-0.2	1.4	78.3	1.8	–	–	–	–	–
Portugal – objectified [1997:11–2007:01]	-0.3	0.9	30.3	1.3	0.78	0.2	0.7	26.0	0.9
Romania – objectified [2001:05–2007:01]	8.4	8.4	63.2	10.6	1.31	8.4	8.4	63.2	10.6
Slovakia – objectified [2000:04–2007:01]	2.0	4.4	102.5	2.3	0.92	1.2	4.1	105.9	1.9
Slovenia – objectified [1996:03–2007:01]	1.2	1.8	33.3	5.0	1.20	1.4	1.6	37.7	4.6
Spain – objectified [1995:01–2007:01]	-1.0	1.1	36.7	1.3	1.15	-1.0	1.2	35.2	1.3
Sweden – objectified [1995:10–2007:01]	-0.2	1.0	273.4	1.3	-0.11	0.1	0.8	224.2	1.0
– subjectified [1995:10–2007:01]	-0.3	0.9	253.4	1.1	-0.88	-0.2	0.8	203.9	0.9
– quantitative [1995:10–2007:01]	0.7	1.0	314.9	1.3	0.05	0.8	0.9	238.4	1.2
UK – objectified [1995:01–2007:01]	-0.6	1.1	47.8	1.3	0.80	-1.1	1.2	40.9	1.4
– subjectified [1995:01–2007:01]	-0.7	1.0	41.1	1.2	-0.27	-1.2	1.3	46.2	1.4
– quantitative [1999:04–2006:04] ²	-0.4	0.7	33.1	0.9	–	–	–	–	–

$$ME = \frac{1}{n} \sum_{t=1}^n (\pi_{t+1|t}^e - \pi_{t+1}) \quad MPE = \frac{1}{n} \sum_{t=1}^n \left(\frac{\pi_{t+1|t}^e - \pi_{t+1}}{\pi_{t+1}} \right) \quad MAE = \frac{1}{n} \sum_{t=1}^n |\pi_{t+1|t}^e - \pi_{t+1}| \quad MAPE = \frac{1}{n} \sum_{t=1}^n \left| \frac{\pi_{t+1|t}^e - \pi_{t+1}}{\pi_{t+1}} \right| \quad RMSE = \sqrt{\frac{1}{n} \sum_{t=1}^n (\pi_{t+1|t}^e - \pi_{t+1})^2}$$

¹ Diebold-Mariano test statistics modification proposed by Harvey, Leybourne and Newbold (1997); */** indicates rejection of hypothesis of equal mean square error of inflation expectations and naive forecasts at 5% and 1% significance level, respectively.

² Quarterly data.

Source: own calculations.

antitative questions in Hungary and Poland (bias of 9.1 and 12.6 p.p., respectively), as well as consumers' inflation expectations in Romania (objectified measure), Hungary (objectified measure) and Poland (objectified measure quantified on the basis of Ipsos survey data), which overstated future inflation by 8.4, 3.4 and 3.4 p.p., respectively. In the period under consideration these three countries experienced large disinflation episodes (in the case of Romania it was as much as from 40% to 4.6%), which were not fully anticipated by consumers. Relatively sizeable errors were committed by consumers in Malta (-2.0 p.p. in the case of subjectified measure of expectations), Slovakia (2.0 p.p., objectified measure) and Greece (2.0 p.p., subjectified measure). On the contrary, the most accurate forecasts were formulated in Finland (subjectified measure: -0.1 p.p.), Poland (modified quantitative measure: -0.2 p.p.), Italy (subjectified measure: -0.2 p.p.), Sweden (objectified measure: -0.2 p.p.; subjectified one: -0.3 p.p.), and Lithuania (objectified measure: -0.3 p.p.). When the assessment of forecast accuracy is confined to the common sample¹¹ (2001:05-2007:01), the results remain to lar-

¹¹ All inflation expectations' measures for Malta and the quantitative objectified measure for Poland are dropped from this comparison as these surveys cover even shorter period. Additionally, measures based on quantitative questions in Hungary and the UK are excluded, as they have a quarterly frequency and very few observations would be covered.

ge extent unchanged, with the exception of Poland (objectified measure quantified on the basis of Ipsos survey data), which performs much better, and Finland (subjectified measure), which performs relatively worse.¹²

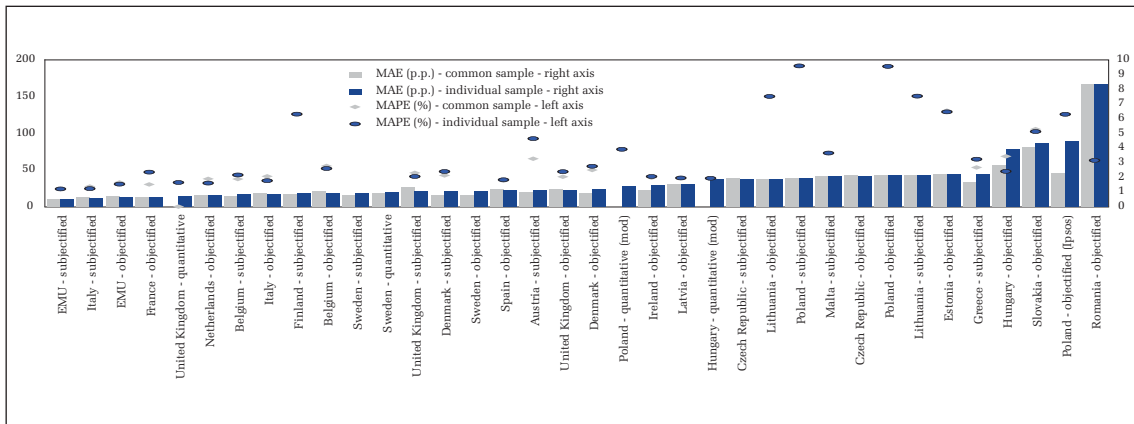
As the analysed countries experienced different inflation levels, it is useful to refer to relative forecasting accuracy indicators. In Sweden (both probability measures), the Czech Republic (both probability measures), Lithuania (subjectified measure) and Poland (all probability measures) expectational errors exceeded on average the future inflation level. At the other end, the best performers included Belgium (both probability measures), the Netherlands (objectified measure), Ireland (objectified measure), Latvia (objectified measure) and the euro area (subjectified measure). The forecast accuracy statistics are summarized in Figure 1.

To assess the usefulness of consumers' expectations measures in predicting inflation, we compare them with naive forecasts in terms of forecasting accuracy. Therefore we conduct the modified Diebold-Mariano test, proposed by Harvey et al. (1997) on no difference in the accuracy of two competing forecasts, assuming loss function represented by mean square error.¹³ The test statistic:

¹² Section 2.3 tests formally the unbiasedness of inflation expectations.

¹³ Test statistic proposed by Harvey et al. (1997) has better small sample properties than the original Diebold-Mariano version of this test.

Figure 1. Forecast performance statistic



Source: own calculations.

$$HNL - DM = \sqrt{\frac{T+1-2h + \frac{h(h-1)}{T}}{T}} \frac{\bar{d}}{\sqrt{\hat{V}(\bar{d})}} \quad (9)$$

where:

- \bar{d} – mean loss differential,
- $\hat{V}(\bar{d})$ – an estimate of asymptotic variance of \bar{d} ,
- h – the forecast horizon
- T – number of observations,

has Student-t distribution with $(T-1)$ degrees of freedom.

The results suggest that consumer inflation expectations have similar forecasting power as naive forecasts (Table 3). Only in a few cases, namely: Denmark (objectified and subjectified measures), Greece (subjectified measure) and Malta (objectified measure), inflation expectations perform worse than the naive forecast. On the contrary, in Poland the subjectified measure of inflation expectations outperformed naive forecast. However, it seems to result from the specificity of the period considered (rise of inflation due to the Polish accession to the UE), as the alternative objectified measure (based on Ipsos survey) covering a longer period is characterised by accuracy not significantly different from the naive forecast.

The presented results suggest that European consumers' inflation expectations are rather poor predictors of future inflation. Forsells and Kenny (2004; 2006) reach a similar conclusion and point out that for the euro area as a whole the errors are smaller than for individual countries. Moreover, they notice improvement in forecast accuracy in the 90-ties. Mestre (2007) finds that probability measures of consumer inflation expectations perform much worse than forecasts based on autoregressive models. However, they are not useless in forecasting as including them in autoregressive models improves their predicting power.

3.2. Testing for causality between actual future inflation and expected inflation

Even if the quantified measures of consumer inflation expectations in the European countries seem to be imperfect predictors of future inflation, it may be the case that consumers use some pieces of information to gradually improve their expectations. Therefore, the next test we apply concerns the causality between actual future inflation and inflation expectations. We follow the approach by Berk (2000), Berk and Hebbink (2006), Forsells and Kenny (2004; 2006). First we test for unit roots and cointegration. Then for those pairs of inflation expectations and actual future inflation, which pass positively the Johansen test on cointegration we estimate two-variable (expected and future actual inflation) vector error correction models (VECMs)¹⁴:

$$\begin{aligned} \Delta \pi_t^e &= \alpha_{10} + \alpha_{11}(\pi_{t-1}^e - \beta \pi_{t+1} + \gamma) + \sum_{i=1}^p \phi_{1i} \Delta \pi_{t-i}^e + \sum_{i=1}^q \psi_{1i} \Delta \pi_{t-i} + \varepsilon_{1t} \\ \Delta \pi_t &= \alpha_{20} + \alpha_{21}(\pi_{t-1}^e - \beta \pi_{t+1} + \gamma) + \sum_{i=1}^p \phi_{2i} \Delta \pi_{t-i}^e + \sum_{i=1}^q \psi_{2i} \Delta \pi_{t-i} + \varepsilon_{2t} \end{aligned} \quad (10)$$

The advantage of this approach is that it allows the interaction between inflation expectations and future inflation to run in both directions. Moreover, such models by Granger Representation Theorem provide additional information on the direction of causality (Engle, Granger 1987). Inflation expectation Granger-cause future actual inflation in the long- and short-run if $\alpha_{21} \neq 0$, and $\alpha_{2i} \neq 0$, respectively. Similarly, the future actual inflation Granger-cause inflation expectations in the long run if $\alpha_{11} \neq 0$, and in the short run – if $\psi_{1j} \neq 0$.¹⁵

For those measures of inflation expectations which fail the cointegration test we conduct the traditional Granger

¹⁴ Lag length in the cointegration test was chosen based on AIC and BC information criteria and the properties of the error term.

¹⁵ For details see: Ericsson et al. (1998).

Table 4. Testing for causality between actual future inflation (π) and expected inflation (π^e)

	Measure of expected inflation:											
	objectified probability measure				subjectified probability measure				balance statistic BS3			
	significance of π^e in equation for π		significance of π in equation for π^e		significance of π^e in equation for π		significance of π in equation for π^e		significance of π^e in equation for π		significance of π in equation for π^e	
	Chi-test	t-test on ECM	Chi-test	t-test on ECM	Chi-test	t-test on ECM	Chi-test	t-test on ECM	Chi-test	t-test on ECM	Chi-test	t-test on ECM
Austria	2.21	1.42	25.9**	3.99**	11.04**	0.70	3.04	3.26**	2.35	1.56	15.41*	3.51**
Belgium	46.20**	0.19	10.7	4.17**	7.03	-	18.50**	-	1.20	2.07	3.33	3.82*
Bulgaria									2.30	4.09**	19.81**	0.29
Cyprus									4.10	1.64	17.44**	4.36**
Czech Republic	0.53	0.27	32.22**	3.86**	2.25	0.15	1.42	3.04**	5.22	-	3.00	-
Denmark	3.45	-	9.50*	-	2.15	-	7.58	-	x	x	x	x
EMU	4.98	0.84	45.30**	4.26**	0.73	1.04	7.42	3.98**	11.26	-	7.40	-
Estonia	4.73	-	18.28**	-					7.50	1.84	1.43	3.96**
Finland					4.35	0.12	16.94**	3.68**	x	x	x	x
France	18.57**	1.41	34.23**	4.69**					x	x	x	x
Germany									12.59	-	21.00**	-
Greece					x	x	x	x	x	x	x	x
Hungary	0.11	9.16	40.97**	6.04**					x	x	x	x
Ireland	4.79	-	26.69**	-					x	x	x	x
Italy	2.13	0.63	10.42	3.90**	2.94	2.76**	3.66	3.19**	7.64	-	4.12	-
Latvia	5.17	-	18.13**	-					24.60**	-	11.96*	-
Lithuania	5.31	-	18.10**	-	0.60	-	2.62	-	2.71	-	15.00**	-
Luxembourg									1.92	0.17	0.19	4.95**
Malta												
Netherlands	x	x	x	x					x	x	x	x
Poland (Ipsos) ¹	8.86*	1.11	23.29**	6.34**					x	x	x	x
Poland (GfK) ²	0.84	0.61	7.77**	5.04**	2.08	0.20	3.01	4.78**	0.41	2.42*	0.47	1.91
Portugal	20.51**	1.95	38.23**	5.05**					x	x	x	x
Romania	4.26	-	20.59**	-					5.19	2.99*	5.10	4.19**
Slovakia	4.26	0.45	23.74**	4.38**					13.30	3.81**	12.24	2.11
Slovenia	2.39	0.16	13.37**	3.76**					2.82	-	7.83	-
Spain	0.61	0.17	16.33**	3.38**					x	x	x	x
Sweden ³	4.41	1.38	50.15**	3.22**	10.84	1.36	17.78*	4.07**	x	x	x	x
UK	3.82	0.77	17.98**	3.99**	3.62	1.73*	4.35	3.42**	4.56	-	6.04	-

** (*) indicates significance at 1% (5%).

x-denotes that no satisfying VAR specification was found; - denotes that there is no cointegration.

¹ Sample: 1995–2006.

² Sample: 2001–2006.

³ For the measure based on quantitative survey questions, the statistics are respectively: 2.15*; 0.04; 0.80; 4.23**.

Source: own calculations.

causality test, based on VARs. There is one important caution in the procedure applied, which might affect the results, namely a relatively small number of observations available for the new EU member states.

Table 4 presents the results of both types of causality tests. We use three measures of inflation expectations, i.e. an objectified probability measure, a subjectified probability measure and the balance statistic BS₃.¹⁶ Results of the short-term analysis confirm the causality running from actual future inflation to objectified probability measures of consumer inflation expectations

¹⁶ BS₃ is included in our testing procedure rather as an experiment – in most cases there was no good VAR or no cointegration.

in almost all countries under consideration. There are only two exceptions, i.e. Belgium, and Italy. The remaining measures are to lesser extent influenced by actual future inflation – in the case of the subjectified probability measure the causality runs from actual future inflation to inflation expectations in Belgium, Finland and Sweden, while in the case of the balance statistic BS₃ – in Austria, Bulgaria, Cyprus, Germany, Latvia and Lithuania. The long-run causality tests' results are much more robust with respect to the quantification method applied. All the measures of consumers' inflation expectations occur to be caused by future inflation with the balance statistic BS₃ in Bulgaria,

Poland and Slovakia being the exceptions. It suggests that European consumers' inflation expectations are to some extent forward-looking.

Test results suggest that the feedback from consumer inflation expectations to actual inflation is rather weak and statistically insignificant. In the long-term analysis the opposite holds for the balance statistic BS_3 in Bulgaria, Poland, Romania and Slovenia, as well as for the subjectified probability measure of consumer inflation expectations in Italy and in the UK. In the short-term analysis there are more expectations' measures having influence on actual inflation, including: the objectified probability measure in Belgium, France and Poland (Ipsos survey), Portugal, the subjectified probability measure in Austria and the balance statistic BS_3 in Latvia.

Our results are consistent with the findings by Forsells and Kenny (2006), who covered a longer sample period, i.e. 1986–2005 using the probability measure of expectations in the euro area and its main economies.

3.3. Unbiasedness of consumer inflation expectations

An important feature of rational expectations is their unbiasedness. According to the rational expectations hypothesis, agents forming expectations use all information available and do not make systematic forecast errors, so their expectations are equal to the actual future inflation on average and to the actual future inflation plus a random forecast error period by period (Muth 1961; Lucas 1976)¹⁷. In line with the unbiasedness requirement, the coefficients β_0 and β_1 in the equation (9) should be equal to zero and one, respectively:

$$\pi_{t+n|t}^e = \beta_0 + \beta_1 \cdot \pi_{t+n} + \varepsilon_t, \quad (11)$$

¹⁷ It should be noted that the problem of expectations' rationality had been introduced to the literature well before Muth (1961) and Lucas (1976) contributions. Keuzenkamp (1991) notices that Tinbergen (1932) had defined expectations' rationality in terms of the consistency of their formation process with the true economic relationships

where:

- π_{t+n} – the actual inflation in period $t + n$,
- $\pi_{t+n|t}^e$ – the expectation of inflation at time $t + n$ formed at time t ,
- ε – a white-noise error.

However, there are theoretical doubts¹⁸ concerning the assumptions of the rational expectations hypothesis, which may lead to inflation expectations bias, at least in the short run. Results of numerous empirical studies suggest that inflation expectations of consumers do not fulfil the unbiasedness requirement¹⁹. For this reason instead of testing the unbiasedness condition in its canonical form, we apply a test of the long-run convergence of inflation expectations to actual future inflation. Such a convergence takes place if the coefficients α_1 and α_2 of the following equation:

$$\pi_{t+n|t}^e = \alpha_1 \cdot \pi_{t+n-1|t-1}^e + \alpha_2 \cdot \pi_{t+n} + \varepsilon_t \quad (12)$$

add to one. Moreover, the lower is α_1 , the faster is the convergence process. It should be noted that the equation (10) allows verifying inflation expectations' unbiasedness by testing the hypothesis that the coefficient α_1 and α_2 are equal to zero and one respectively. According to estimation results (Table 5), consumer inflation expectations in all countries do not fulfil this condition, however, in the majority of analysed economies expectations converge to the actual inflation ex-post in the long run. The speed of convergence is relatively low and diversified between dif-

¹⁸ The prominent role here is played by sticky-information models. Mankiw and Reis (2002) suggest that because of the costs of acquiring information and/or of price reoptimization pricing decisions are not always based on current information. Another important input here, developed by Reis (2005) and Sims (2005), suggests that the process of acquiring and processing information that is an important part of forming inflation expectations by economic agents should be in itself treated as an outcome of rational (optimizing) behaviour.

¹⁹ E.g.: Bakhshi, Yates (1998) – inflation expectations of the UK employees, Mestre (2007) – consumer inflation expectations in the euro area, Forsells, Kenny (2004, 2006) – consumer inflation expectations in the euro area and its main economies, Łyziak (2005) – consumer inflation expectations in Poland, Koszczyński et al. (2006) – consumer inflation expectations in Poland and the Czech Republic

Table 5. Long-run convergence of expectations towards actual inflation

Country/measure	Unrestricted estimates (1)		H0: [$\alpha_1 + \alpha_2 = 1$]		Restricted estimates ²	Speed of convergence ³ (No. of months)
	α_1	α_2	F-stat.	[p-val]		
Austria						
– objectified [1995:10–2007:01]	0.945***	0.044**	0.51	[0.48]	0.957***	13
– subjectified [1995:10–2007:01]	0.857***	0.156*	0.27	[0.61]	0.858***	5
Belgium						
– objectified [1995:01–2007:01]	0.945***	0.037*	0.73	[0.40]	0.968***	22
– subjectified [1995:01–2007:01]	0.911***	0.055**	4.00	[0.05]	0.966***	21
Czech Republic						
– objectified [2001:01–2007:01]	0.952***	0.033	0.20	[0.66]	0.937***	11 4
– subjectified [2001:01–2007:01]	0.932***	0.044	0.70	[0.41]	0.955***	– 4
Denmark						
– objectified [1995:01–2007:01]	0.923***	0.037**	3.84	[0.05]	0.984***	43
– subjectified [1995:01–2007:01]	0.885***	0.061***	9.02	[0.00]	–	–

Country/measure	Unrestricted estimates ¹		H ₀ : [$\alpha_1 + \alpha_2 = 1$]		Restricted estimates ²	Speed of convergence ³ (No. of months)
	α_1	α_2	F-stat.	[p-val]		
EMU						
– objectified [1995:01–2007:01]	0.940***	0.041***	2.63	[0.11]	0.976***	29
– subjectified [1995:01–2007:01]	0.951***	0.038***	2.98	[0.09]	0.974***	27
Estonia						
– objectified [2001:04–2007:01]	0.923***	0.080	0.01	[0.93]	0.923***	9 ⁴
Finland						
– subjectified [1996:07–2007:01]	0.953***	0.045***	0.09	[0.77]	0.955***	16
France						
– objectified [1995:01–2007:01]	0.890***	0.073***	3.61	[0.06]	0.951***	14
Greece						
– subjectified [1995:01–2007:01]	0.752***	0.349***	12.30	[0.00]	–	–
Hungary						
– objectified [1995:01–2007:01]	0.915***	0.103***	1.16	[0.28]	0.943***	12
– quantitative objectified [2000:01–2006:04]	0.782***	0.229***	0.11	[0.74]	0.788***	12
Ireland						
– objectified [1998:03–2007:01]	0.962***	0.029	0.35	[0.56]	0.974***	27 ⁴
Italy						
– objectified [1995:01–2007:01]	0.915***	0.064**	1.58	[0.21]	0.941***	12
– subjectified [1995:01–2007:01]	0.766***	0.213***	1.45	[0.23]	0.783***	3
Latvia						
– objectified [2001:05–2007:01]	0.918***	0.086***	0.08	[0.78]	0.913***	8
Lithuania						
– objectified [2001:05–2007:01]	0.939***	0.068*	0.03	[0.87]	0.935***	11
– subjectified [2001:05–2007:01]	0.982***	0.018*	0.00	[0.99]	0.982***	39
Malta						
– objectified [2002:11–2007:01]	0.847***	0.093*	1.77	[0.19]	0.921***	9
– subjectified [2002:11–2007:01]	0.973***	0.018	0.03	[0.87]	0.985***	– ⁴
Netherlands						
– objectified [1995:01–2007:01]	0.912***	0.075**	0.27	[0.61]	0.925***	9
Poland						
– objectified [2001:05–2007:01]	0.930***	0.048**	0.77	[0.39]	0.936***	11
– subjectified [2001:05–2007:01]	0.916***	0.077***	0.10	[0.75]	0.917***	8
– objectified (Ipsos) [1995:01–2007:01]	0.903***	0.104**	0.10	[0.75]	0.911***	8
– quantitative objectified [2003:05–2007:01]	0.886***	0.117***	0.01	[0.92]	0.884***	6
Portugal						
– objectified [1997:11–2007:01]	0.934***	0.064**	0.03	[0.86]	0.936***	11
Romania						
– objectified [2001:05–2007:01]	0.900***	0.131*	0.84	[0.36]	0.933***	10
Slovakia						
– objectified [2000:04–2007:01]	0.885***	0.104**	0.11	[0.74]	0.883***	6
Slovenia						
– objectified [1996:03–2007:01]	0.888***	0.128***	1.47	[0.23]	0.907***	8
Spain						
– objectified [1995:01–2007:01]	0.947***	0.035***	2.69	[0.10]	0.982***	39
Sweden						
– objectified [1995:10–2007:01]	0.926***	0.039	1.68	[0.20]	0.949***	– ⁴
– subjectified [1995:10–2007:01]	0.942***	0.027**	3.11	[0.08]	0.973***	26
– quantitative [1995:10–2007:01]	0.962***	0.040**	0.04	[0.85]	0.962***	36
UK						
– objectified [1995:01–2007:01]	0.956***	0.030*	1.29	[0.26]	0.974***	27
– subjectified [1995:01–2007:01]	0.917***	0.055***	5.50	[0.02]	–	–
– quantitative [1999:04–2006:04]	0.885***	0.104**	0.48	[0.49]	0.906***	32

¹ Estimates of parameters of equation: $\pi_{t+1}^e = \alpha_1 \cdot \pi_{t+1}^e + \alpha_2 \cdot \pi_{t+2}^e$; OLS estimators; Newey-West standard errors in parentheses.

² Estimates of parameters of equation: $\pi_{t+1}^e = \alpha \cdot \pi_{t+1}^e + (1-\alpha) \cdot \pi_{t+2}^e$; OLS estimators; Newey-West standard errors in parentheses.

³ Half life of expectations' deviation from REH.

⁴ As in some economies coefficients α_1 and α_2 add to unity but coefficient on future inflation is statistically insignificant, an additional test was conducted on restricted estimates. If the null hypothesis of being equal to 1 is not rejected, as it happened for subjectified measure in the Czech Republic, Malta and objectified measure in Sweden, it is concluded that there is no convergence to actual future inflation. In the case of objectified measure in the Czech Republic, Estonia and Ireland this hypothesis is rejected at 5% significance level.

Source: own calculations.

ferent measures of expectations. In the case of objectified probability measures the estimate of α_1 varies from approximately 0.88 in Slovakia to 0.98 in Denmark. It corresponds to the number of months needed to absorb 50% of deviations of expectation from the long-run level (half-life of deviations) equal, respectively, 6 and 43. Half-life deviation estimates for subjectified probability indicators of inflation expectations are between 3 (Italy) and 39 months (Lithuania), while for quantitative ones – between 6 (Poland) and 36 months (Sweden).

4. Conclusions

Theoretical developments concerning the role of inflation expectations in economic relationships make empirical analysis in this area particularly needed. In this study we used survey measures of consumer inflation expectations in the European economies, which were quantified with different methods. Before using these measures in testing selected features of consumer inflation expectations we introduced a scheme of assessing their reliability.

The following conclusions can be drawn from the empirical part of our paper (Table 6): Firstly, the forecasting accuracy of quantified measures of consumer inflation expectations in Europe is rather poor and comparable to the accuracy of naive forecasts. Secondly, the paper provides evidence for the long-run

causality running from the actual future inflation to consumer inflation expectations, while the assessment of causality in the short-term dynamics depends on the measure of expectations applied. The impact of the actual future inflation on inflation expectations suggests that consumers are to some extent forward-looking. Thirdly, although the unbiasedness condition of rational expectations is not fulfilled in any economy under consideration, the majority of measures demonstrate the long-run convergence toward the actual future inflation, with respect to which they are formed. It may mean that a kind of learning process takes place, but according to our estimation results its speed, diversified across countries, seems to be rather slow on average.

The results presented in this study may be useful in selecting those measures of consumer inflation expectations, which perform well in terms of their leading properties with respect to the actual future inflation and as such should be embodied in monetary authorities' information sets. It should be noted, however, that there are still many areas in the empirical economics of inflation expectations, which need to be covered by analysis. Development of theoretical concepts combined with problems in measuring consumer inflation expectations provide incentives to assess existing approaches more rigorously and look for other methods of extracting this unobservable variable from consumer surveys and consumer behaviour.

Table 6. *Summary of results*

Country/measure	Forecast performance		Long run convergence		Does future inflation influence inflation expectations...	
	ME (p.p.)	RMSE (p.p.)	Does it converge to actual inflation?	Speed of convergence	in short term?	in long term?
Austria - objectified [1995:10-2007:01] - subjectified [1995:10-2007:01]	-0.5 0.4	1.1 1.4	Yes Yes	13 5	Yes No	Yes Yes
Belgium - objectified [1995:01-2007:01] - subjectified [1995:01-2007:01]	-0.6 -0.6	1.1 1.0	Yes Yes	22 21	No Yes	Yes -
Bulgaria - objectified [2001:05-2007:01] - subjectified [2001:05-2007:01]	x x	x x	x x	x x	x x	x x
Cyprus - objectified [2001:05-2007:01] - subjectified [2001:05-2007:01]	x x	x x	x x	x x	x x	x x
Czech Republic - objectified [2001:01-2007:01] - subjectified [2001:01-2007:01]	0.4 0.6	2.6 2.4	Yes No	11 -	Yes No	Yes Yes
Denmark - objectified [1995:01-2007:01] - subjectified [1995:01-2007:01]	-1.1 -1.0	1.3 1.2	Yes No	43 -	Yes No	- -
EMU - objectified [1995:01-2007:01] - subjectified [1995:01-2007:01]	-0.5 -0.3	0.8 0.6	Yes Yes	29 27	Yes No	Yes Yes
Estonia - objectified [2001:04-2007:01] - subjectified [2001:04-2007:01]	0.6 x	2.5 x	Yes x	9 x	Yes x	- x
Finland - objectified [1996:07-2007:01] - subjectified [1996:07-2007:01]	x -0.1	x 1.1	x Yes	x 16	x Yes	x Yes
France - objectified [1995:01-2007:01] - subjectified [1995:01-2007:01]	-0.5 x	0.8 x	Yes x	14 x	Yes x	Yes x

Country/measure	Forecast performance		Long run convergence		Does future inflation influence inflation expectations...	
	ME (p.p.)	RMSE (p.p.)	Does it converge to actual inflation?	Speed of convergence	in short term?	in long term?
Germany – objectified [1995:01–2007:01]	x	x	x	x	x	x
– subjectified [1995:01–2007:01]	x	x	x	x	x	x
Greece – objectified [1995:01–2007:01]	x	x	x	x	x	x
– subjectified [1995:01–2007:01]	2.0	3.1	No	–	–	–
Hungary – objectified [1995:01–2007:01]	3.4	5.3	Yes	12	Yes	Yes
– subjectified [1995:01–2007:01]	x	x	x	x	x	x
– quantitative objectified [2000:01–2006:04]	0.7	2.0	Yes	12	–	–
Ireland – objectified [1998:03–2007:01]	-1.0	2.0	Yes	27	Yes	–
– subjectified [1998:03–2007:01]	x	x	x	x	x	x
Italy – objectified [1995:01–2007:01]	-0.5	1.0	Yes	12	No	Yes
– subjectified [1995:01–2007:01]	-0.2	0.7	Yes	3	No	Yes
Latvia – objectified [2001:05–2007:01]	-1.0	2.0	Yes	8	Yes	–
– subjectified [2001:05–2007:01]	x	x	x	x	x	x
Lithuania – objectified [2001:05–2007:01]	-0.3	2.4	Yes	11	Yes	–
– subjectified [2001:05–2007:01]	-0.4	2.3	Yes	39	No	–
Luxembourg – objectified [2002:01–2007:01]	x	x	x	x	x	x
– subjectified [2002:01–2007:01]	x	x	x	x	x	x
Malta – objectified [2002:11–2007:01]	-1.3	1.8	Yes	9	x	x
– subjectified [2002:11–2007:01]	-2.0	2.2	No	–	–	–
Netherlands – objectified [1995:01–2007:01]	-0.4	1.1	Yes	9	Yes	Yes
– subjectified [1995:01–2007:01]	x	x	x	x	x	x
Poland – objectified [2001:05–2007:01]	0.5	2.6	Yes	11	Yes	Yes
– subjectified [2001:05–2007:01]	1.0	2.3	Yes	8	No	Yes
– objectified (Ipsos) [1995:01–2007:01]	3.4	5.6	Yes	8	Yes	Yes
– quantitative objectified [2003:05–2007:01]	-0.1	1.8	Yes	6	–	–
Portugal – objectified [1997:01–2007:01]	-0.3	1.3	Yes	11	Yes	Yes
– subjectified [1997:01–2007:01]	x	x	x	x	x	x
Romania – objectified [2001:05–2007:01]	8.4	10.6	Yes	10	Yes	–
– subjectified [2001:05–2007:01]	x	x	x	x	x	x
Slovakia – objectified [2000:04–2007:01]	2.0	2.3	Yes	6	Yes	Yes
– subjectified [2000:04–2007:01]	x	x	x	x	x	x
Slovenia – objectified [1996:03–2007:01]	1.2	5.0	Yes	8	Yes	Yes
– subjectified [1996:03–2007:01]	x	x	x	x	x	x
Spain – objectified [1995:01–2007:01]	-1.0	1.3	Yes	39	Yes	Yes
– subjectified [1995:01–2007:01]	x	x	x	x	x	x
Sweden – objectified [1995:10–2007:01]	-0.2	1.3	No	–	Yes	Yes
– subjectified [1995:10–2007:01]	-0.3	1.1	Yes	26	Yes	Yes
– quantitative [1995:10–2007:01]	0.7	1.3	Yes	36	No	Yes
UK – objectified [1995:01–2007:01]	-0.6	1.3	Yes	27	Yes	Yes
– subjectified [1995:01–2007:01]	-0.7	1.2	No	–	No	Yes
– quantitative [1999:04–2006:04]	-0.4	0.9	Yes	8	–	–

x denotes that given measure of inflation expectations is considered as unreliable.

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