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Do Consumers in Europe Anticipate Future Inflation?

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Do Consumers in Europe Anticipate Future Inflation?

Has It Changed Since the Beginning of the Financial Crisis?

ABSTRACT: *In this paper we analyze whether consumers in European economies are able to anticipate future inflation. For this purpose we check expectational errors and estimate the degrees of forward-lookingness and macroeconomic efficiency of consumer inflation expectations. We also test the impact of the recent financial crisis on the formation of these expectations. Our results suggest that capacities of consumers to anticipate future inflation are rather constrained, although their opinions contain some forward-looking elements. Consumers seem to anticipate future inflation to the highest extent in France, Cyprus, the European Monetary Union as a whole, and the Netherlands. There is also a relatively high degree of anticipation in Austria, Belgium, Estonia, Hungary, Italy, Latvia, Poland, and Slovakia. Consumer inflation expectations in advanced economies display better forecasting properties and higher degrees of forward-lookingness and efficiency than expectations in transition economies. Finally, our results suggest that the global financial crisis has influenced the formation of inflation expectations in both groups of economies.*

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The aim of this paper is to use survey-based measures of inflation expectations to assess the degree to which consumers in the economies in the European Union (EU) anticipate future price developments. Quantifying inflation expectations with the probability approach introduced by Carlson and Parkin (1975) and developed by Batchelor and Orr (1988), among others, we propose a novel method for quantifying perceived inflation that serves as a scaling factor in the quantification of inflation expectations.

Using survey-based measures of consumer inflation expectations, we analyze differences in expectation formation across individual countries as well as between two groups of economies (advanced and transitional). In addition, an important issue considered in the study is the impact of the financial crisis that began in 2008 on the formation of consumer inflation expectations.

The degree to which economic agents are able to anticipate future price developments is usually assessed with the weight of future inflation in the hybrid model of the formation of expectations (e.g., Gerberding 2001, 2010). In the context of cross-country comparisons, however, such a measure can be misleading. For instance, the same weight of future inflation in the formation of inflation expectations can coexist with expectational errors of different magnitudes, which in addition can be either purely random or caused by imperfect use of available information. Therefore, in this study we assess the extent to which consumers in Europe anticipate future price changes in a more complex way, applying a three-step procedure. In addition to estimating the relative weight of forward- and backward-looking mechanisms in the formation of inflation expectations, we assess the magnitude of inflation expectational errors and test the macroeconomic efficiency of inflation expectations; in other words, the degree to which consumers efficiently process available information, approximated by a set of different macroeconomic variables. If inflation expectations were characterized jointly by a relatively high degree of forward-lookingness, low errors, and high macroeconomic efficiency, we could conclude that consumers effectively anticipate future inflation. Our analysis is conducted separately for individual EU economies and for two groups of economies—advanced and transitional (using panel data).

Literature Review

Theoretical Remarks

Macroeconomic theory underlines the importance of expectations in determining economic outcomes. Various specifications of the Phillips curve suggested by different schools of economic thought—that is, the expectations-augmented Phillips curve (Friedman 1968; Phelps 1967), the New Keynesian Phillips curve (Goodfriend and King 1997), or the hybrid Phillips curve (Fuhrer and Moore 1995; Roberts 1997)—predict that prices in the economy depend on expectations, and that the way in which expectations are formed influences the effectiveness of the monetary transmission mechanism.

According to monetarist models, adjustment of expectations to macroeconomic news is relatively slow, and expectations are of an extrapolative (backward-looking) nature. It is the main feature of *adaptive expectations* (Cagan 1956), which depend on their past values and past expectational errors. *Static expectations,* which depend only on the most recent inflation, constitute a special case of adaptive expectations.

Neoclassical economics replaced the assumption of adaptive expectations with the *rational expectations hypothesis* (Lucas 1972). It assumes that economic agents fully exploit available information in the absence of information asymmetries and do not make systematic errors in assessing future macroeconomic performance. Therefore, inflation expectations are equal to actual future inflation on average; in other words, they are unbiased predictors of future inflation. An important additional characteristic of rational expectations is their macroeconomic efficiency (orthogonality of expectational errors with respect to available information).

In most New Keynesian models, inflation expectations are treated as rational, but in some of them *hybrid models* of expectations (e.g., Galí and Gertler 1999; Roberts 1997) are also used. They allow for heterogeneity of economic agents, and therefore inflation expectations are represented as a combination of rational and extrapolative (adaptive or static) expectations.

Modern economic theory indicates several factors that can affect the share of economic agents making forward-looking expectations. First, such a share depends on the type of economic agents under consideration. Different groups of agents may use different models, may have different information sets, or may have different capacities for processing information (Pfajfar and Santoro 2010). Therefore it is plausible to assume a higher degree of forward-lookingness of expectations made by professional forecasters than by consumers, whose analytical capacities are restricted. In addition, theories of *sticky information* or *rational inattention* (Mankiw and Reis 2002; Sims 2003) suggest that the formation of expectations by a given group of economic agents depends on the costs of updating and processing information. As a result, rational agents can find that the costs of making informed forecasts can exceed the benefits. Theoretical models of *near rationality* assume that economic agents collect and process information better when it is important, which, in the context of inflation expectations, means periods of high and volatile inflation. In the low-inflation environment, a segment of economic agents can ignore inflation expectations in their decisions concerning prices and wages or—even if there is a role for expectations—they are formed in a simple, incomplete manner (e.g., Akerlof et al. 2000).

Empirical Remarks

The existing empirical literature suggests that inflation expectations of European consumers are neither fully backward looking nor fully forward looking. However, the former mechanisms seem stronger than the latter (Gerberding 2001, 2010; Łyziak 2010b).

Forsells and Kenny (2010) show that survey-based measures of consumer inflation expectations in the eurozone as a whole and selected economies from the eurozone (France, Germany, Italy, Netherlands, Spain) usually outperform naive models or autoregressive models in terms of forecasting accuracy. An opposite conclusion is drawn by Mestre (2007), who shows better forecasting properties of autoregressive models than of survey-based measures of consumer inflation expectations in the eurozone. However, after including consumer inflation expectations in such models, their forecasting accuracy is improved.

According to a dominant number of empirical studies aimed at testing the main requirements of the rational expectations hypothesis, the consumer inflation expectations of European consumers do not satisfy the unbiasedness condition, whereas the macroeconomic efficiency of those expectations (i.e., their orthogonality with respect to available information) seems relatively high. In setting their inflation expectations, consumers in the eurozone efficiently use past expectational errors (Gerberding 2010) and available information on gross domestic product (GDP), monetary aggregate M3, interest rates, exchange rates, as well as producer prices and commodity prices (Forsells and Kenny 2010). It should be emphasized that in the 1990s, the degree of macroeconomic efficiency of consumer inflation expectations in the eurozone increased considerably relative to the earlier period (Forsells and Kenny 2004).

Consumer inflation expectations in the eurozone adjust to actual future inflation, but this process—due to information stickiness—is gradual (Forsells and Kenny 2004). Döepke et al. (2008), using the epidemiological model, show that consumer inflation expectations in France, Germany, Italy, and the United Kingdom are to some extent forward looking, because they take into account not only past inflation rates, but also inflation forecasts of professional forecasters.

Measurement of Consumer Inflation Expectations in Europe

Survey Data

In the study, we use survey data on expected price changes from the European Commission Consumer Survey, which is carried out every month in EU economies.[1] The qualitative question included in this survey has the following form: "By comparison with the past twelve months, how do you expect that consumer prices will develop in the next twelve 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, (6) don't know." There is an additional qualitative question concerning the perception of current price movements, whose results can be useful in quantifying the expected rate of inflation: "How do you think that consumer prices have developed over the last twelve months? They have (1) risen a lot, (2) risen moderately, (3) risen slightly, (4) stayed about the same, (5) fallen, (6) don't know."

Survey responses are publicly available for a majority of the EU economies: Austria, Belgium, Cyprus, Czech Republic, Estonia, the eurozone as a whole, Finland, France, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Netherlands, Poland, Romania, Slovakia, Slovenia, Spain, Sweden, and the United Kingdom. The common sample of observations used in this paper starts in May 2001 and ends in July 2012. Due to the fact that there is a break in survey data for Ireland (from May 2008 to April 2009), this economy is not considered in the paper.

Quantification

In quantifying consumer inflation expectations we apply the probability method. We refer to the canonical Carlson and Parkin (1975) approach, modified in order to use all information embodied in the survey data (Batchelor and Orr 1988). In quantifying inflation expectations, we assume that the expected inflation is normally distributed in the population. To scale survey responses, we use a measure of perceived inflation that is calculated on the basis of survey data.

To derive perceived inflation with the probability method, it is assumed that in selecting the response to the survey question, respondents who notice an increase in prices of different magnitudes compare perceived price dynamics with a *moderate rate of inflation* that reflects a permanent or trend rate of price change.[2] The most frequent ways of defining the moderate inflation used in the literature are based on moving averages of current inflation (Łyziak 2010a), running means of current inflation (Nielsen 2003), or averages of price dynamics in the sample period (Reckwerth 1997). In this paper we propose a novel method of selecting the appropriate measure of moderate inflation instead of defining it in the ad hoc manner. We analyze different proxies for this variable, including moving averages of current inflation (2 to 48 lags are checked) and the running mean of inflation from the beginning of the sample. For each of these proxies, we derive the Spearman rank correlation coefficients between the deviation of current price dynamics from a given measure of moderate inflation and the balance statistic of survey opinions on perceived price changes, attaching weights of 1.5, 1, 0.5, 0, and –1 to subsequent fractions of respondents to the survey question. The proxy producing the highest correlation is selected as the best measure of moderate inflation to be used in quantifying the perceived rate of inflation.

In the majority of economies under consideration, the running mean of inflation constitutes the best proxy for moderate inflation, which suggests that European consumers have a relatively long memory of price developments. The moving average of current price dynamics is indicated as the adequate measure of moderate inflation in five remaining economies: Estonia (27-month moving average), the Czech Republic (29-month moving average), Austria (35-month moving average), as well as in Greece (48-month moving average), and Hungary (48-month moving average).[3]

Analysis of Survey Measures of Inflation Expectations

Survey data from the European Commission Consumer Survey vary across the analyzed economies, both in terms of the opinions on price changes during the previous twelve months and predicted price changes during the next twelve months. There are also significant differences concerning average price dynamics and average levels of quantified measures of inflation perception and expectations (Table 1). In order to reduce the impact of outlier observations, in cross-country comparisons we use medians instead of means.

Balance statistics of inflation perception, attaching weights of 1.5, 1, 0.5, 0, and –1 to subsequent fractions of respondents, reach their maximum value in Greece and their minimum in Sweden. Italian consumers seem the most optimistic in assessing future price developments, while Hungarian consumers form the most pessimistic views in this respect. Analogous balance statistics of inflation expectations are on average lower than balance statistics of inflation perceptions.

As far as quantification results are concerned, in the majority of the economies studied, inflation perceived by consumers is equal to current inflation or exceeds it on average. The gap between both series is particularly large (approximately 5.6 percentage points) in Romania—the economy characterized by the highest price dynamics in the sample. In other economies, the inflation perception gap is relatively low on average, or even negative (in the Czech Republic, Estonia, Finland, Lithuania, Sweden, and the United Kingdom).[4]

In line with the survey responses, quantified measures of inflation expectations are usually lower than perceived inflation. The Appendix presents quantified measures of perceived and expected inflation for all the economies under consideration.

Estimating the Degree to Which Consumers Anticipate Future Inflation

Methods Applied

In the cross-country comparisons, more forward-looking expectations may not necessarily be associated with lower forecasting errors. Therefore in the first step of our analysis we calculate and analyze inflation expectational errors. In the second step, we estimate two types of hybrid models of the formation of inflation expectations. Both of them assume that expectations have a hybrid nature, being to some extent backward looking and to some extent forward looking. The difference between both specifications concerns the model used in the extrapolative part of the equation—it is either adaptive (Equation (1))[5] or static (Equation (2)):

$$\pi^{e}_{t+12|t} = \alpha_1 + \alpha_2\pi_{t+12} + (1-\alpha_2)[\pi^{e}_{t-2|t-14} + \alpha_3(\pi^{e}_{t-2|t-14} - \pi_{t-2}) + \alpha_4(\pi^{p}_{t} - \pi_{t-2})] + \beta d^{f.crisis} + \varepsilon_t \quad (1)$$

Table 1. **Survey Data and Quantified Measures of Inflation Perception and Expectations Versus Current Inflation—Sample Medians**

	Balance statistic of			Quantified measures of	
	Perceived inflation	Expected inflation	Current inflation (percent)	Perceived inflation (percent)	Expected inflation (percent)
Austria	0.37	0.27	2.0	2.0	1.5
Belgium	0.51	0.16	2.3	2.6	1.9
Cyprus	0.39	0.31	2.8	2.8	2.5
Czech Republic	–0.12	0.32	2.3	1.1	1.1
EMU	0.38	0.15	2.1	2.1	1.5
Estonia	0.45	0.41	4.2	4.1	4.4
Finland	–0.04	0.25	1.7	1.0	0.7
France	0.46	0.15	1.8	2.0	1.3
Greece	0.63	0.29	3.3	4.6	3.7
Hungary	0.36	0.54	5.1	6.0	6.9
Italy	0.35	–0.05	2.3	2.3	1.2
Latvia	0.41	0.37	4.5	4.5	4.2
Lithuania	0.32	0.51	3.0	2.5	2.9
Netherlands	0.28	0.19	1.9	2.1	1.8
Poland	0.29	0.31	3.1	3.1	2.6
Romania	0.58	0.50	8.1	13.7	15.1
Slovakia	0.30	0.43	3.8	4.7	4.7
Slovenia	0.38	0.30	3.1	3.3	3.1
Spain	0.49	0.19	3.0	3.4	2.3
Sweden	–0.18	0.23	1.6	0.7	0.6
United Kingdom	0.12	0.17	2.1	1.4	1.0
Minimum	–0.18	–0.05	1.6	0.7	0.6
1st quartile	0.29	0.19	2.1	2.0	1.3
Median	0.37	0.29	2.8	2.6	2.3
3rd quartile	0.45	0.37	3.3	4.1	3.7
Maximum	0.63	0.54	8.1	13.7	15.1

$$\pi^{e}_{t+12|t} = \alpha_1 + \alpha_2\pi_{t+12} + (1 - \alpha_2)\pi_{t-2} + \alpha_4(\pi^{p}_{t} - \pi_{t-2}) + \beta d^{f.crisis} + \varepsilon_t, \qquad (2)$$

where $\pi^{e}_{t+i|t}$ denotes inflation expectations formed at time t with respect to inflation at time $t + i$, π_t denotes inflation at time t,[6] π^{p}_{t} is perceived inflation at time t, and $d^{f.crisis}$ is a dummy that equals 1 since the beginning of the financial crisis until the end of the sample period. The final assessment of the degree of forward-lookingness of expectations (α_2) is based on the version of the test equation displaying the best statistical properties in a given economy. If the hypothesis that the estimated parameter α_2 equals 1 is not rejected, it suggests that inflation expectations are fully

forward looking and meet the unbiasedness requirement of the rational expectations hypothesis. If the estimation results show that α_2 is insignificantly different from zero, inflation expectations are fully backward looking: either adaptive or static.

In the third step we test another important requirement of the rational expectations hypothesis, the orthogonality of expectational errors with respect to available information (macroeconomic efficiency of expectations). We verify if selected macroeconomic variables affecting inflation and available when inflation expectations are set (Ω_t)—including the short-term interest rate, the exchange rate, industrial output, oil prices, and current inflation—affect expectational errors ($e_t = \pi^e_{t|t-12} - \pi_t$). For each of the information variables we estimate the following equation:[7]

$$e_t = \alpha_0 + \alpha_1 \cdot \Omega_t + \alpha_2 \cdot e_{t-1} + \varepsilon_t. \tag{3}$$

Due to possible problems with multicollinearity, which could appear while estimating the above equation in a multivariate context, univariate regressions are run. A statistically significant α_1 would suggest that agents failed to take account of the selected information variable in an optimal way in assessing future price developments.

Testing the degrees of forward-lookingness and macroeconomic efficiency of inflation expectations, we use both individual-country data and panel data. The main objective of applying the latter approach is to analyze the impact of the financial crisis that began in 2008 on the formation of consumer inflation expectations.

Results

Expectational Errors

To analyze errors of consumer inflation expectations (Table 2, Figure 1), both within the economies under consideration and in cross-country comparisons, we refer to median errors (MdE) and median absolute percentage errors (MdAPE) instead of mean errors (ME) and mean absolute percentage errors (MAPE). In this way we try to minimize the impact of outlier observations on the results of our study.

In 2001–12, consumers in the majority of European economies underestimated future inflation—the MdE was, on average, approximately –0.7 percentage points. Inflation expectations of consumers were close to actual future inflation in Estonia, Greece, Cyprus, and the Netherlands, while expectational errors were significantly positive only in Hungary, Slovakia, Slovenia, and (especially) Romania. Taking into account cross-country differences in price dynamics, the interquartile range of expectational errors (as measured with MdAPE) is between 40 and 68 percent. Greece displays the lowest MdAPE (29 percent), and Romania the highest (128 percent). It should be noted that many economies—including Cyprus, Estonia, France, Hungary, Latvia, Netherlands, Slovakia, Slovenia, Spain, and the European Mon-

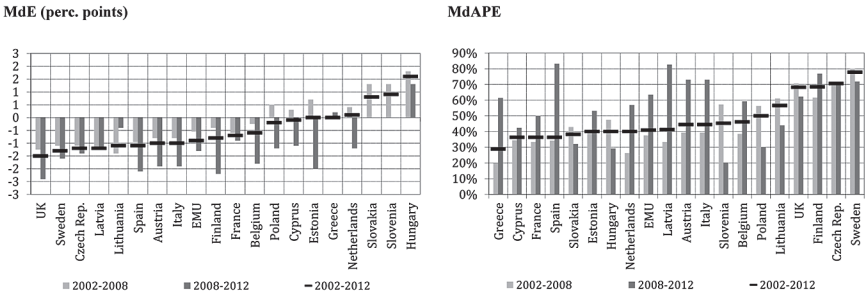
Table 2. **Inflation Expectational Errors—Sample Medians**

	MdE			MdAPE, pct.		
	2001–2012	2001–2008	2008–2012	2001–2012	2001–2008	2008–2012
Austria	–1.00	–0.80	–1.90	44	39	73
Belgium	–0.60	–0.25	–1.80	46	38	59
Cyprus	–0.10	0.30	–1.10	36	34	42
Czech Republic	–1.20	–1.10	–1.40	71	71	70
EMU	–0.90	–0.55	–1.30	41	38	63
Estonia	0.00	0.70	–2.00	40	40	53
Finland	–0.80	–0.40	–2.20	68	62	77
France	–0.70	–0.60	–0.90	36	33	50
Greece	0.00	0.00	0.20	29	20	61
Hungary	1.60	1.80	1.30	40	47	29
Italy	–1.00	–0.80	–1.90	44	39	73
Latvia	–1.20	–1.25	–1.20	41	33	83
Lithuania	–1.10	–1.40	–0.40	57	61	44
Netherlands	0.10	0.40	–1.20	40	26	57
Poland	–0.20	0.50	–1.20	50	56	30
Romania	10.00	10.50	7.50	128	124	174
Slovakia	0.80	1.30	0.00	38	43	32
Slovenia	0.90	1.3	0.00	45	57	20
Spain	–1.10	–0.95	–2.10	36	34	83
Sweden	–1.30	–1.10	–1.60	78	80	72
United Kingdom	–1.50	–1.25	–2.40	68	71	62
Minimum	–1.50	–1.40	–2.40	29	20	29
1st quartile	–1.10	–0.95	–1.90	40	34	45
Median	–0.70	–0.40	–1.20	44	40	61
3rd quartile	0.00	0.50	–0.40	68	62	73
Maximum	10.00	10.50	7.50	128	124	174

etary Union (EMU) as a whole—are quite homogeneous in terms of forecasting accuracy, with MdAPE oscillating closely around 40 percent.

The financial crisis, whose acute phase began in 2008, influenced forecasting accuracy of survey-based measures of consumer inflation expectations. In the majority of the economies, expectational errors increased. It was due to a significant fall in price dynamics, making inflation in some of the countries even negative. At the same time there was an improvement in forecasting accuracy of consumer inflation expectations after the beginning of the financial crisis in Lithuania, Poland, Slovakia, Slovenia, Sweden, and the United Kingdom.

Figure 1. **Inflation Expectational Errors—Sample Medians**



Note: To make the graphs transparent, we do not present outlier observations for Romania.

Forward-Lookingness and Macroeconomic Efficiency of Expectations, Individual Data

The degree of forward-lookingness of expectations in 2001–12, as assessed on the basis of the estimation results of models of hybrid expectations, seems relatively small (Table 3). The median share of forward-looking consumers slightly exceeds 10 percent. There is a relatively high degree of forward-lookingness of inflation expectations in Estonia (33 percent), France (30 percent), Netherlands (27 percent), and the eurozone as a whole (20 percent). Consumers in Greece, Hungary, Romania, Slovakia, Slovenia, Spain, and the United Kingdom form their inflation expectations in a fully backward-looking manner. In the remaining economies, consumer inflation expectations display intermediate degrees of forward-lookingness.[8]

Analysis of macroeconomic efficiency of consumer inflation expectations in European economies suggests that some of the macroeconomic variables available while setting inflation expectations were efficiently processed (i.e., did not lead to systematic forecast errors; see Table 3). This pertains especially to industrial output and the U.S. dollar exchange rate, efficiently used in, respectively, eighteen and fourteen of the analyzed economies. Consumers in Cyprus, Poland, Romania, and Slovenia process available information in a relatively better way than consumers in the remaining economies. The lowest degree of macroeconomic efficiency of consumer inflation expectations is noted in Estonia, Greece, and Lithuania.

Forward-Lookingness and Macroeconomic Efficiency of Expectations, Panel Data

In addition to analysis based on individual country data, we conduct panel estimations to answer three questions: What was the formation process of consumer inflation expectations in the whole sample of countries? Were there any differences

Table 3. **Degree of Forward-Lookingness of Expectations Based on the Estimates of Equation (1)/(2) and Variables Efficiently Processed** (individual-country data)

		Variables efficiently processed				
	Degree of forward-lookingness (α_2)	Short-term interest rate	USD exchange rate	Industrial output	Oil price	CPI inflation
Estonia	0.33	+		+		
France	0.30	+	+	+		
Netherlands	0.27		+	+		+
EMU	0.20	+	+	+		
Belgium	0.17		+	+		
Latvia	0.17	+		+		
Finland	0.16					
Poland	0.16	+	+	+	+	
Austria	0.13	+	+	+		
Cyprus	0.13	+	+	+		+
Italy	0.11	+		+		+
Lithuania	0.11		+			
Sweden	0.09			+		+
Czech Republic	0.08	+		+		
Greece	0.00		+			
Hungary	0.00		+	+	+	
Romania	0.00	+		+	+	+
Slovakia	0.00	+	+	+		
Slovenia	0.00	+	+	+		+
Spain	0.00		+	+		
United Kingdom	0.00		+	+		+
Minimum	0.00					
1st quartile	0.00					
Median	0.11					
3rd quartile	0.17					
Maximum	0.33					

Note: Detailed estimates are in Appendix Tables A1 and A2.

between advanced and transition economies in the way inflation expectations were formed? Did the global financial crisis introduce any changes in this respect? In particular, an interesting question is whether the manner in which the recent financial crisis influenced formation of consumer inflation expectations differs between transition and advanced European economies.[9]

Table 4. **The Degree of Forward-Lookingness of Expectations: Estimation Results of Equation (2)** (panel data)

	Full sample (2001:05–2012:07)	Precrisis sample (2001:05–2008:08)	Crisis sample (2008:09–2012:07)
All countries	0.12**	0.03	0.15***
	(0.05)	(0.06)	(0.04)
Advanced economies	0.17***	0.13*	0.17***
	(0.07)	(0.08)	(0.06)
Transition economies	0.11**	0.02	0.15***
	(0.05)	(0.07)	(0.05)

* Significant at the 0.10 level; ** significant at the 0.05 level; *** significant at the 0.01 level.

The full sample includes all analyzed countries in the period from May 2001 to July 2012. The group of advanced economies includes Austria, Belgium, Cyprus, Finland, France, Greece, Italy, the Netherlands, Spain, Sweden, and the United Kingdom. The group of transition economies includes the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, and Slovenia. For the full sample and the two groups of countries we estimate two versions of the hybrid models of expectations—Equations (1) and (2).[10] We report results of the hybrid model, in which the extrapolative part is static, because it displays better statistical properties, but the results obtained for the hybrid model with adaptive expectations are very similar.[11] In all cases we estimate the equations with fixed effects using generalized method of moments (GMM) with lagged current inflation, lagged perceived inflation, and lagged inflation expectations as instruments. In order to check whether the financial crisis has changed the way inflation expectations are formed, we estimate the test equations for the whole period (May 2001–July 2012) as well as for two subperiods: the precrisis subperiod (May 2001–August 2008) and the crisis subperiod (September 2008–July 2012). Table 4 shows the estimated degree of forward-lookingness of expectations (α_2). Similar to the case of the individual-country results, the estimated degree of forward-lookingness is rather low in the European countries, but when we compare the estimated value for the precrisis subperiod and the crisis subperiod we observe a significant increase of the weight of forward-looking consumers in recent years. In the precrisis subperiod, the estimated coefficient α_2 was not significantly different from zero, while in the crisis subperiod it reached 0.15 (Table 4). In transition economies the estimated degree of forward-lookingness in the two subperiods is lower than for advanced countries. However, the results suggest that in both groups of countries there has been an improvement in the way consumers form their expectations.[12] Moreover, in transition economies forward-lookingness of expectations has increased more than

in advanced economies, so the difference between these two groups of countries has decreased and become insignificant.

The results based on the full sample period seem intuitive. A higher degree of forward-lookingness of consumer inflation expectations in advanced economies is probably due to the fact that in these economies inflation was lower and more stable, so it was easier to forecast it than in transition economies, where inflation was more volatile. Moreover, the degree of economic literacy in developed economies is likely to be higher than in transition economies, so consumers in these countries were more capable of interpreting available information and making informed inflation forecasts.

Disturbances, such a global financial crisis, may affect the expectation formation process in different ways. The overall effect may result from several factors, which seems to be the case in the formation of consumer inflation expectations in Europe in recent years. First, financial crisis disturbances have made it more difficult to forecast inflation accurately. Acquiring and collecting information as well as making predictions has become more costly. This factor alone has probably led to a reduction in the degree of forward-lookingness of consumers' inflation expectations. Second, however, the time of the outburst of the crisis coincided with a strong increase of inflation, which reversed in 2009, when a strong decrease of price dynamics (even to negative values in some of the economies) was observed. When inflation is high or unstable, it becomes more costly to make inaccurate inflation forecasts. Such inflation developments were likely to make the degree of forward-lookingness increase, because they created incentives for consumers to make efforts and search for information in order to forecast inflation. Therefore the aforementioned two factors operated in opposing directions. Our results suggest that the latter effect was stronger than the former, making European consumers more forward looking. A third factor, however, also may have played a role: Namely in countries that experienced high inflation in recent history—such as European transition economies—the public is probably more sensitive to inflation. Therefore, in these countries people are more willing to pay a higher cost in order to predict inflation more precisely than in countries that have no memory of high inflation. This may explain why, after the beginning of the crisis, the degree of forward-lookingness of expectations increased by more in the transition economies in our sample than in the advanced economies.

Similarly we proceed with panel estimation of macroeconomic efficiency of consumer inflation expectations. Estimation is conducted with the full sample of countries as well as using two subsamples (i.e., advanced and transition European economies for the whole period and two subperiods). We estimate Equation (3) using the GMM method with fixed effects. The results (Table 5) seem to suggest a slightly better performance of European advanced economies in terms of macroeconomic efficiency than the results obtained for individual countries. The main difference between transition and advanced economies concerns the impact of current inflation on expectational errors. Data on inflation were processed efficiently

Table 5. **Estimates of the Coefficient α_2 in Equation (3)** (panel data)

	All economies	Advanced economies	Transition economies
Short-term interest rate			
2001–2012	–0.04	0.04	–0.05
	(0.03)	(0.09)	(0.03)
2001–2008	–0.03	0.02	–0.05
	(0.05)	(0.07)	(0.05)
2008–2012	–0.06**	–0.10	–0.03
	(0.03)	(0.13)	(0.04)
USD exchange rate			
2001–2012	0.28	0.68**	–1.60***
	(1.05)	(0.27)	(0.56)
2001–2008	–0.87	0.44***	–2.86**
	(1.04)	(0.17)	(1.17)
2008–2012	0.95*	0.20	1.60*
	(0.58)	(1.11)	(0.82)
Industrial output			
2001–2012	0.00	–0.00	–0.00
	(0.01)	(0.00)	(0.01)
2001–2008	0.00	0.00	0.00
	(0.01)	(0.00)	(0.01)
2008–2012	–0.00	–0.00	0.00
	(0.00)	(0.00)	(0.01)
Oil price			
2001–2012	0.70***	0.57***	0.73***
	(0.12)	(0.13)	(0.20)
2001–2008	0.46*	1.06***	0.36
	(0.24)	(0.37)	(0.35)
2008–2012	0.59***	0.40**	0.74***
	(0.17)	(0.20)	(0.26)
CPI inflation			
2001–2012	0.07***	0.03	0.07***
	(0.01)	(0.02)	(0.01)
2001–2008	0.08***	–0.00	0.09***
	(0.01)	(0.02)	(0.02)
2008–2012	0.08***	0.05	0.07***
	(0.01)	(0.04)	(0.02)

* Significant at the 0.10 level; ** significant at the 0.05 level; *** significant at the 0.01 level.

in the advanced economies, whereas in transition economies they were not. As far as the whole sample period is concerned, in both groups of countries consumers failed to take into account oil price and exchange rate data efficiently, while expectational errors were orthogonal with respect to the short-term interest rate and industrial output. However, it is worth mentioning that consumers in transition countries stopped efficiently processing data on oil prices after the outbreak of the financial crisis, while in the advanced economies there has been improvement in processing data on the U.S. dollar exchange rate. Therefore, when we analyze the precrisis and crisis subperiods separately, we can observe some improvement in the macroeconomic efficiency of expectations in the advanced economies and some worsening in the transition ones.

Cross-Check of the Results

The results presented above suggest that European consumers are able to anticipate future price developments only to a limited extent, although there are significant differences in this respect both among individual economies and between groups of economies. To assess the extent to which European consumers anticipate future inflation, we consider different dimensions of this problem. To summarize the results we calculate the index that assesses the performance of individual economies as compared to all the economies under consideration. It is based on subindices of forecasting accuracy, degree of forward-lookingness, and macroeconomic efficiency of consumer inflation expectations. Calculating each of them, we divide the economies into four groups, in which a given feature is either below the first quartile of its distribution in all countries under consideration, between the first and second quartiles, between the second and third quartiles, or above the third quartile.

The *accuracy subindex* amounts to 0 if the median absolute percentage error in a given economy exceeds the third quartile of the distribution of MdAPE in the whole group of countries. Scores 1, 2, and 3 apply if the error is, respectively, within the ranges between the median and the third quartile, between the first and the second quartile, or below the first quartile of the distribution. The *forward-lookingness subindex* is constructed in a similar way, but in this case the score 0 is given for those economies in which the degree of forward-lookingness is below the first quartile of the distribution in the whole group of economies, a score of 1 is assigned if the degree of forward-lookingness is between the first and second quartiles, a score of 2 if the degree of forward-lookingness is between the second and third quartiles, and a score of 3 for economies in which the weight of the forward-looking element in the formation of inflation expectations exceeds the value of the third quartile. The *macroeconomic efficiency subindex* is calculated in the same way on the basis of the percentage of macroeconomic variables that are processed efficiently by consumers in a given economy. The aggregated index used to assess the degree to which consumers in a given country anticipate inflation is calculated as a sum of the three subindices described above.

Table 6. **Anticipation Index and Its Components** (individual country data)

	Relative performance in terms of			
	Expectational errors	Forward-lookingness	Macroeconomic efficiency	Sum
France	3	3	3	9
Cyprus	3	2	3	8
EMU	2	3	3	8
Netherlands	2	3	3	8
Austria	1	2	3	6
Estonia	2	3	1	6
Italy	1	2	3	6
Latvia	2	3	1	6
Poland	1	2	3	6
Slovakia	3	0	3	6
Belgium	1	3	1	5
Hungary	2	0	3	5
Spain	3	0	1	4
Slovenia	1	0	3	4
Greece	3	0	0	3
Romania	0	0	3	3
United Kingdom	0	0	3	3
Lithuania	0	2	0	2
Czech Republic	0	1	1	2
Finland	0	2	0	2
Sweden	0	1	1	2

The subindices defined above are not highly correlated with each other (Table 6). It is true that in none of the countries in which the forward-lookingness subindex reaches its maximum value the remaining subindices are equal to zero, which means that in these economies expectational errors are relatively small and the degree of macroeconomic efficiency is relatively high. However, there are economies displaying a relatively high degree of macroeconomic efficiency in which expectational errors are fairly high, while the estimated degree of forward-lookingness is rather low (Romania, Slovenia, United Kingdom). At the same time, from a cross-country perspective a high degree of forward-lookingness does not necessarily imply low expectational errors (Belgium). Therefore it seems that applying a multidimensional approach leads to a more reliable assessment of the extent to which consumers anticipate future inflation.

Considering all the analyzed features, we can conclude that consumers seem to anticipate future price developments to the highest extent in Cyprus, France, EMU as a whole, and the Netherlands. There is also a relatively high degree of

Table 7. **Spearman Rank Correlation Between Selected Features of Inflation Expectations and Inflation in Analyzed Economies**

		Measures used to calculate subindices		
	Anticipation index	Expectational errors (MdAPE)	Degree of forward-lookingness	Degree of macroeconomic efficiency
Average inflation	–0.60*	–0.32	–0.36	0.00
	(0.00)	(0.16)	(0.12)	(0.98)
Average perceived inflation	0.24	–0.55*	–0.22	0.21
	(0.30)	(0.01)	(0.35)	(0.37)
Inflation volatility	–0.47*	0.54*	0.05	–0.39*
	(0.04)	(0.01)	(0.84)	(0.09)

Notes: Probability values in parentheses. * Spearman ranks statistically different from zero.

anticipation in Austria, Estonia, Italy, Latvia, Poland, and Slovakia as well as in Belgium and Hungary.

To obtain an economic interpretation of cross-country differences in the formation of consumer inflation expectations, we analyze the Spearman rank correlations between the anticipation index (or the measures used to calculate its subindices) and selected features of inflation in the analyzed economies (Table 7). We take into account the average levels of inflation and perceived inflation as well as inflation volatility measured with the coefficient of variation.

We find a statistically significant negative rank correlation between the anticipation index and inflation volatility. It suggests that in the economies experiencing high inflation volatility, costs of making informed, forward-looking forecasts are high, and therefore expectations are formed in a simple, incomplete manner.[13] Reviewing the details, we observe a statistically significant rank correlation between inflation volatility and both the magnitude of expectational errors and the degree of macroeconomic efficiency. In the economies with high inflation volatility, expectational errors are higher while the degree of macroeconomic efficiency is lower than in the economies with relatively low inflation volatility.

In addition, a lower inflationary environment makes consumers more forward looking, although this correlation is not strong and there are two economies (Estonia and Latvia) with relatively high degrees of forward-lookingness and relatively high average inflation. Finally, there is a negative correlation between the average level of perceived inflation and inflation expectational errors. Such an effect seems consistent with the predictions of theoretical models of near rationality that assume better use of available information by economic agents during the periods of relatively high inflation.

Table 8. **Anticipation of Inflation Expectations** (panel data)

	All economies	Advanced economies	Transition economies
Expectational errors (MdAPE)			
2001–2012	0.44	0.44	0.45
2001–2008	0.40	0.38	0.56
2008–2012	0.61	0.62	0.44
Forward-lookingness (weight of future inflation in formation of expectations)			
2001–2012	0.11	0.17	0.11
2001–2008	0.03	0.13	0.03
2008–2012	0.14	0.17	0.14
Macroeconomic efficiency (number of variables efficiently processed of five analyzed)			
2001–2012	3	3	2
2001–2008	3	3	3
2008–2012	1	4	2

The results of the panel data analysis (Table 8) show that, independently of the sample under consideration, consumer inflation expectations in the advanced economies display higher degrees of forward-lookingness and macroeconomic efficiency than inflation expectations in transition economies. Interestingly, analyzing the impact of the recent financial crisis on the way consumer inflation expectations are formed in European economies, we can observe on the one hand a deterioration of both forecasting accuracy and macroeconomic efficiency of expectations, but on the other hand an increase in the degree of their forward-lookingness. Analyzing advanced and transition economies separately, it appears that relative to the precrisis period, in 2008–12 there was an increase of the degree of forward-lookingness of consumer inflation expectations in both groups of countries. It was accompanied by an increase in macroeconomic efficiency of expectations in advanced economies, while transition economies faced deterioration in this respect. It is worth noting that the financial crisis period has led to an increase in inflation expectational errors in advanced economies, while it has improved forecasting accuracy in transition economies. As a result, in the recent period expectational errors in transition economies have become lower than in the advanced economies.

Conclusions

In the study, we analyze three separate features of consumer inflation expectations that describe the extent to which economic agents anticipate future price

developments: (1) the weight of future inflation in the hybrid model of inflation expectations; (2) the degree of macroeconomic efficiency; and (3) inflation expectational errors. The reason for this approach is to obtain a broader view of the informational content of expectations of European consumers. However, in contradiction to intuition, our results show that these characteristics are not closely correlated with each other in the panel of EU economies under consideration. This means that one has to examine additional features of inflation expectations in order to evaluate their performance in the cross-country perspective.

Empirical measures of consumer inflation expectations used in the study are quantified on the basis of European Commission Survey data with the probability method. Within this method we propose a novel algorithm for defining the moderate inflation that includes the process of quantification of perceived and expected inflation.

According to our findings, European consumers experience problems with anticipating price developments. Consumers usually underestimate future inflation, and the interquantile range of expectational errors is between 40 and 68 percent of actual future inflation. Some of the macroeconomic variables available to consumers for setting expectations (in particular industrial output and the exchange rate) are efficiently processed. The median of the degree of forward-lookingness of inflation expectations slightly exceeds 10 percent. It is higher in advanced economies than in transition economies. Taking all the analyzed features into account, we can conclude that consumers anticipate future inflation to the highest extent in Cyprus, France, the EMU as a whole, and the Netherlands. There is also a relatively high degree of anticipation in Austria, Estonia, Italy, Latvia, Poland, and Slovakia, as well as in Belgium and Hungary. Explaining cross-country differences in this respect we find that in the economies with relatively high inflation volatility, as measured by the coefficient of variation, consumers are less able to anticipate future price developments than in the economies in which inflation is relatively stable.

On the basis of the results obtained, we may infer that the global financial crisis that began in 2008 has influenced the formation of consumer inflation expectations in the European countries, but its impact has been slightly different in advanced and transition economies. Taking into account all economies under consideration, we can observe on the one hand a deterioration of forecasting accuracy of consumer inflation expectations and less efficient use of available information, and on the other an increase in the degree of forward-lookingness of expectations. In the advanced economies, inflation expectational errors have increased, but the degrees of forward-lookingness and macroeconomic efficiency of inflation expectations have increased only slightly. Transition economies have experienced a significant increase in the degree of forward-lookingness of inflation expectations and an improvement in their forecasting accuracy, but the use of available information by consumers in these economies has become somewhat less efficient.

Notes

1. A detailed description of the European Commission Consumer Survey is provided in European Commission (2006, 2007).

2. Respondents declaring that "prices have risen a lot" are assumed to think that current inflation is higher than moderate inflation plus a sensitivity parameter. Inflation perceived by respondents claiming that "prices have risen moderately" is assumed to fall within a sensitivity interval surrounding the moderate inflation, while inflation perceived by those claiming that "prices have risen slightly" is located between the sensitivity parameter surrounding zero—in which implicit perceptions of the respondents observing no change in the price level are located—and the moderate inflation minus sensitivity parameter. Implied price dynamics perceived by respondents selecting the response that "prices have fallen" is below the lower bound of the sensitivity interval surrounding zero.

3. In the case of Romania and Slovenia, which experienced a relatively long disinflation phase and where the differences in price dynamics at the beginning and the end of the period under consideration are the highest among the analyzed economies, such a method—indicating the cumulative mean of current inflation as the best proxy for moderate inflation—leads to the unrealistic persistence of its high levels. Therefore we define the moderate inflation in a different manner: as a linear interpolation of inflation based on its levels in the first and second halves of the samples. Curto-Millet (2006) proposes such a method to capture the trending behavior of the moderate rate.

4. If Romania is eliminated from the sample, the average difference between perceived and official inflation in the EU economies under consideration is close to zero.

5. A similar specification was used in some empirical studies—for instance, Carlson and Valev (2002), Gerberding (2001), and Heineman and Ullrich (2006). In its backward-looking part, in addition to standard determinants of adaptive expectations, the specification additionally takes into account a possible impact of a gap between perceived current inflation and officially measured inflation on inflation expectations.

6. At time t, the current inflation known when the survey is conducted, is π_{t-2}.

7. Due to a strong autocorrelation of forecast errors—which does not contradict the rational expectations hypothesis, given that the horizon of analyzed expectations is longer than the frequency of the data—we include the lagged expectational error on the right-hand side of the equation. This substantially improves statistical properties of the estimation results.

8. Łyziak (2010b) presents similar estimates based on four measures of inflation expectations quantified with different methods for each of the EU economies under consideration. Using the measure of inflation expectations proposed in this study for the sample period analogous to the one used in Łyziak (2010b) (i.e., November 2002–May 2007), in the majority of economies we obtain very similar degrees of forward-lookingness. Significant differences concern the degree of forward-lookingness in three economies—Estonia (18 percent, according to the present method versus 0 percent according to Łyziak 2010b), Latvia (8 percent versus 24 percent, respectively), and the United Kingdom (27 percent versus 0 percent, respectively).

9. Furceri and Zdzienicka (2011) analyzed changes in economic activity after the start of the crisis in eleven European transition economies and advanced European countries. They found that the effect of the crisis was considerably larger in the transition economies.

10. In the panel estimation we did not use the crisis dummy.

11. The estimated degree of forward-lookingness of expectations (α_2) in this model is slightly higher than in the hybrid model with static expectations in its backward-looking part, but the developments are the same.

12. It should be noted that earlier studies, covering the first two years of the financial crisis, indicated a decrease in the degree of forward-lookingness of consumer inflation

expectations in the eurozone after the beginning of the financial crisis (e.g., see Łyziak 2013: section 4.4).

13. Interestingly, all four economies in which the anticipation index is the lowest (i.e., Czech Republic, Finland, Lithuania, and Sweden) display a relatively high inflation volatility.

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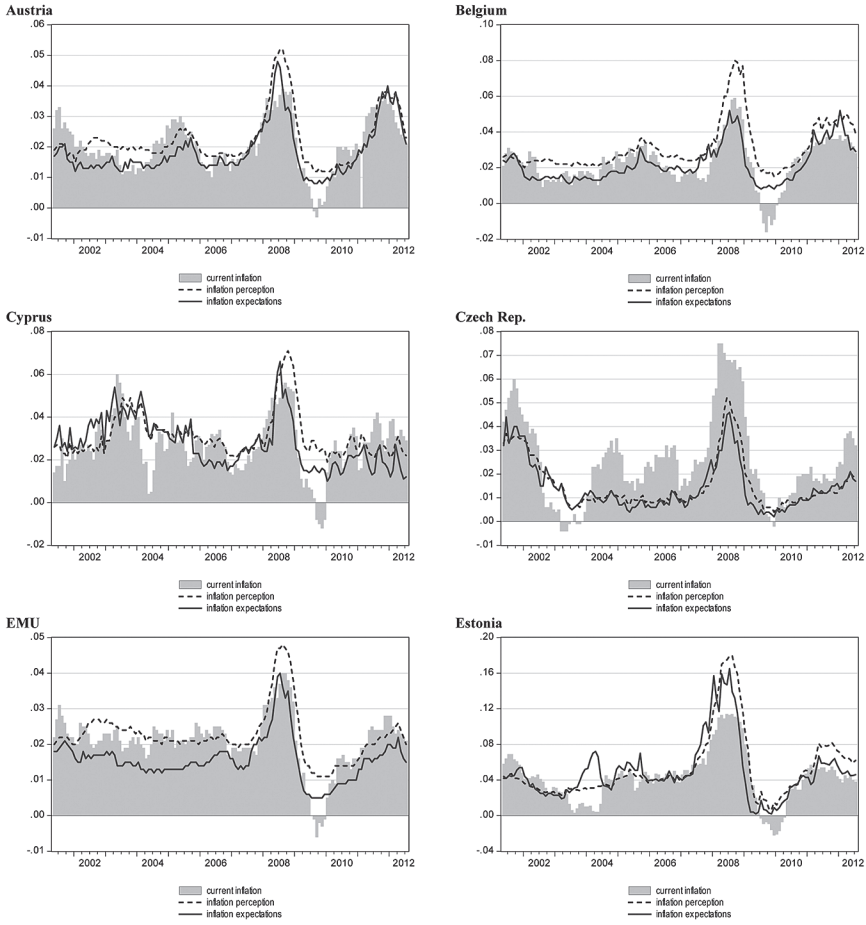
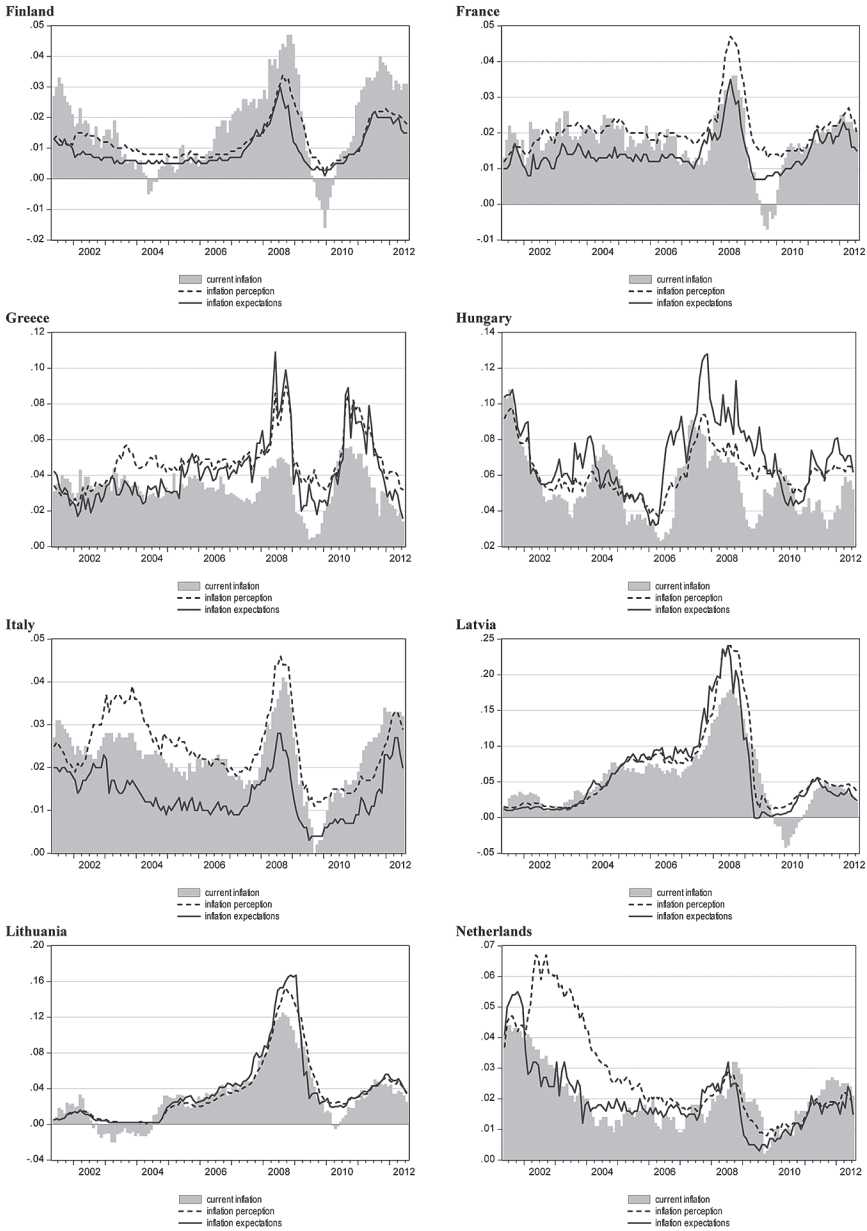
Appendix

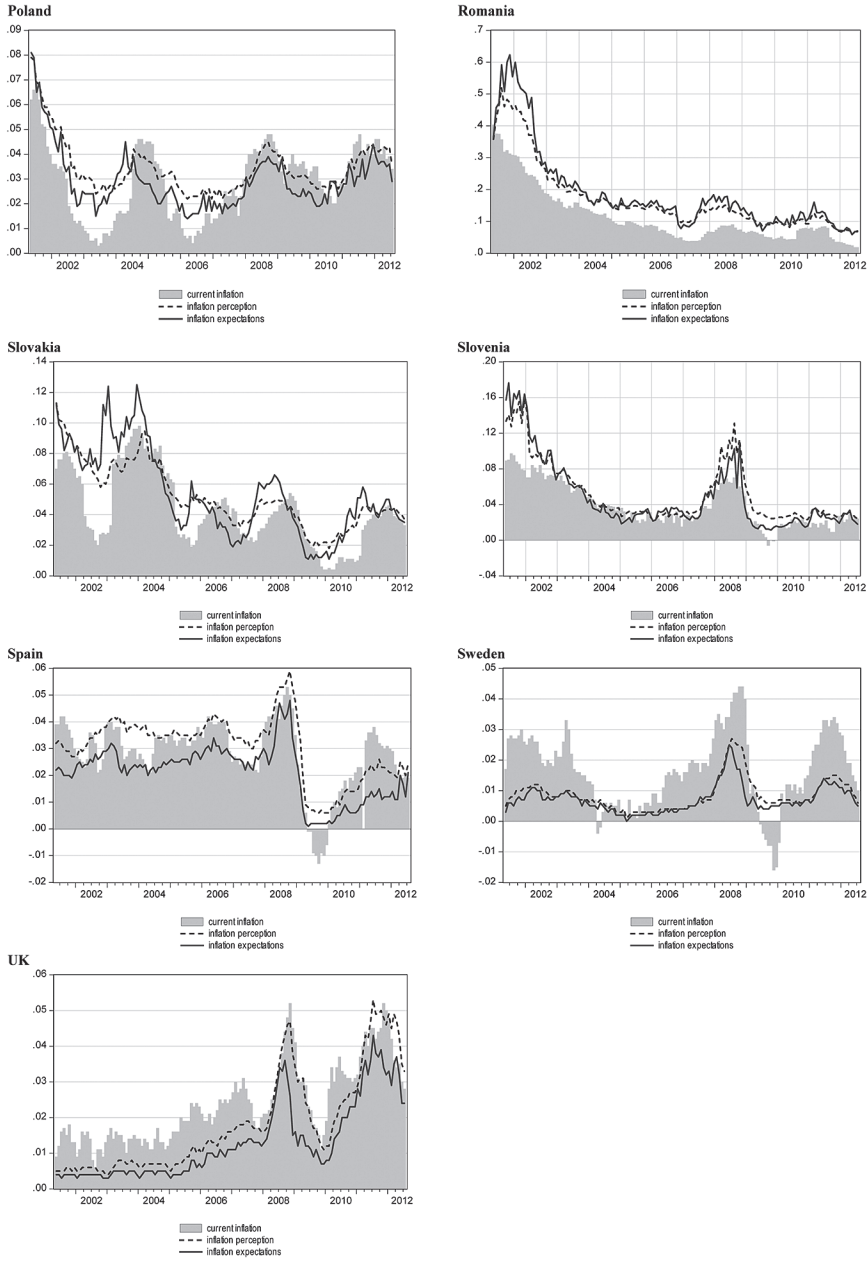
Figure A1. **Current Inflation and Quantified Measures of Inflation Perceptions and Expectations**



(continues)

Figure A1 *(Continued)*





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

Table A1. **Estimation Results of Equation (1)/(2)** (individual country data)

	Equation version,[2] R^2_{adj}	Weight of forward-lookingness, α_2	Weight of backward-lookingness $(1 - \alpha_2)$	α_3	α_4	β
Austria	A*	0.13	0.87	–1.00	0.79	–0.001
	0.92	(0.05)		(0.11)	(0.35)	(0.000)
Belgium	A*	0.17	0.83	–0.63	—	–0.004
	0.81	(0.05)		(0.03)		(0.001)
Cyprus	A	0.13	0.87	–0.96	—	–0.010
	0.70	(0.08)		(0.14)		(0.002)
Czech Rep.	S*	0.08	0.92	X	0.92	–0.003
	0.92	(0.04)			(0.07)	(0.001)
EMU	A*	0.20	0.80	–0.92	0.67	—
	0.91	(0.05)		(0.07)	(0.25)	
Estonia	A	0.33	0.67	X	1.66	–0.014
	0.89	(0.06)			(0.31)	(0.003)
Finland	A*	0.16	0.84	–1.12	1.20	–0.002
	0.87	(0.04)		(0.11)	(0.19)	(0.001)
France	S*	0.25	0.75	X	0.46	—
	0.67	(0.06)			(0.12)	
Greece	S	—	1	X	0.60	—
	0.72				(0.10)	
Hungary	S*	—	1	X	0.76	—
	0.63				(0.24)	
Italy	A*	0.11	0.89	–0.75	—	—
	0.74	(0.05)		(0.06)		

Latvia	A	0.17	0.83	–1.15	1.14	—
	0.95	(0.07)		(0.05)	(0.05)	
Lithuania	A	0.11	0.89	–1.23	1.66	—
	0.95	(0.06)		(0.07)	(0.24)	
Netherlands	S*	0.27	0.73	X	–0.01	–0.009
	0.79	(0.14)			(0.00)	(0.001)
Poland	A*	0.16	0.84	–1.11	1.18	—
	0.71	(0.08)		(0.15)	(0.34)	
Romania	A	—	1	–0.96	1.15	—
	0.94			(0.03)	(0.09)	
Slovakia	A	—	1	–1.08	1.07	—
	0.74			(0.09)	(0.31)	
Slovenia	S	—	1	X	0.48	—
	0.90				(0.10)	
Spain	A*	—	1	–0.82	0.55	—
	0.93			(0.03)	(0.11)	
Sweden	A*	0.09	0.91	–0.94	0.94	–0.003
	0.87	(0.03)		(0.11)	(0.17)	(0.001)
United Kingdom	A*	—	1	–0.69	—	—
	0.67			(0.11)		

Notes: Estimation technique: Following standard practice, actual future inflation is used as a measure of rational expectations. As a consequence, the error term of the estimated equation includes the expectations error of rational expectations (see Fair 1993). Therefore, the two-stage least squares method (2SLS) is used to estimate both versions of the test equation with constant and twelve lags of current inflation being the instruments (in line with Gerberding 2001). A = estimated equation is consistent with specification (1); S = alternative version of the test Equation (2). * Constant used in the estimated equation.

Table A2. **Estimation Results of Parameter α_1 in Equation (3)** (individual country data)

	Short-term interest rate	USD exchange rate	Industrial output	Oil price	CPI inflation
Austria	0.07	–0.98	0.00	0.42*	0.08*
	(0.05)	(0.61)	(0.01)	(0.16)	(0.04)
Belgium	0.12*	1.23	0.01	0.83*	0.08*
	(0.06)	(0.85)	(0.01)	(0.19)	(0.03)
Cyprus	0.06	0.93	0.00	0.83*	0.03
	(0.06)	(1.20)	(0.01)	(0.31)	(0.03)
Czech Republic	0.12	–1.09*	0.00	0.41*	0.05*
	(0.08)	(0.56)	(0.00)	(0.17)	(0.02)
EMU	0.06	–0.83	0.01	0.44*	0.07*
	(0.04)	(0.55)	(0.01)	(0.14)	(0.03)
Estonia	0.06	–3.68*	0.01	1.45*	0.10*
	(0.12)	(2.10)	(0.01)	(0.52)	(0.04)
Finland	0.09*	–1.09*	0.01*	0.46*	0.05*
	(0.04)	0.52	(0.00)	(0.13)	(0.02)
France	0.05	–0.77	0.01	0.45*	0.05*
	(0.04)	(0.50)	(0.01)	(0.14)	(0.03)
Greece	0.24*	–1.82	0.04*	1.31*	0.28*
	(0.11)	(1.45)	(0.01)	(0.28)	(0.06)
Hungary	0.08*	–0.56	–0.01	–0.10	0.08*
	(0.04)	(0.83)	(0.00)	(0.21)	(0.04)
Italy	0.04	–0.74*	0.00	0.30*	0.04
	(0.03)	(0.38)	(0.00)	(0.11)	(0.03)
Latvia	0.00	–5.61*	0.01	1.46*	0.11*
	(0.04)	(2.92)	(0.01)	(0.48)	(0.04)
Lithuania	0.19*	–2.38	0.02*	1.40*	0.12*
	(0.08)	(2.02)	(0.01)	(0.50)	(0.04)
Netherlands	0.05*	–0.80	0.00	0.31*	0.04
	(0.02)	(0.50)	(0.00)	(0.10)	(0.04)
Poland	0.03	–0.04	–0.01	0.04	0.03*
	(0.03)	(0.22)	(0.01)	(0.11)	(0.02)
Romania	0.01	0.07*	–0.04	0.25	–0.02
	(0.05)	(0.04)	(0.03)	(0.71)	(0.05)
Slovakia	0.02	–1.24	0.00	0.44*	0.07*
	(0.07)	(0.89)	(0.01)	(0.26)	(0.04)
Slovenia	0.08	–2.09	0.00	0.78*	0.07
	(0.05)	(1.30)	(0.01)	(0.33)	(0.05)
Spain	0.10*	–0.97	0.00	0.63*	0.06*
	(0.06)	(0.87)	(0.01)	(0.21)	(0.03)
Sweden	0.07*	–0.84*	0.00	0.36*	0.04
	(0.04)	(0.44)	(0.00)	(0.19)	(0.02)
United Kingdom	0.05*	–0.57	0.01	0.44*	–0.01
	(0.03)	(0.54)	(0.01)	(0.17)	(0.07)

* Significant at the 0.10 level.