Forward-looking component in consumers' expectations and inflation forecast targeting: the case of six European economies[*]

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Abstract

Since there are different ways of revealing central banks' intentions, a simple research question, which we address in this study, arises. Is the forward-looking (FL) component of consumers' expectations related to the way in which the forecast is revealed and used by central banks? The research covers six countries: The Czech Republic, Hungary, Romania, Poland, Sweden, and the UK, over the period of 2001-2016. Our methodology consists of the quantification of expectations, tests for rationality of expectations, estimation of the degree of their FL, the index-based assessment of central banks' forecasting transparency and importance of forecasts in monetary policy, as well as correlation examination of forward-lookingness of monetary policy and expectation errors. Based on the completed research, we link the results of the FL analysis to the index-based assessment of inflation forecasts targeting. The results are varied. The highest degree of expectations' FL is found for the UK and Sweden. Czech consumers' expectations are less FL, whereas central banks' involvement in inflation forecast targeting is comparable to the Swedish case. For two countries we found no forward-looking component in consumers' expectations. The study makes a valid contribution to the existing literature as it presents a novel approach to analysing the relation between forecasts and inflation forecast targeting and expectations.

Key words: *inflation forecast, inflation forecast targeting, consumers' expectations, forward-lookingness of expectations*

JEL classification: *E580, E430*

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1. Introduction

Monetary policy has become significantly more transparent since 1990s. Transparency, together with a monetary policy framework, is likely to enhance the formation of expectations among economic agents. Rationality of expectations is one of the basic assumptions for the modern economic theory. However, this fundamental assumption is questioned with great frequency (Mitchell and Weale, 2007; Kokoszczyński, Łyziak and Stanisławska, 2010; Łyziak, 2014; Dräger, 2015). In this paper, we aim at investigating whether the central banks' practice in forecasting inflation, revealing their forecasts and following the inflation forecast targeting (IFT) support the formation of economic agents' expectations. In this examination, we hypothesize that greater central banks' forward-lookingness (expressed in their involvement in IFT) is the starting point for more forward-looking expectations (a higher degree of FL and more accurate expectations).

Forward-lookingness of expectations that we analysed in this study refers to the rational component of expectations. To form them, the public should understand the economic model and any information that might affect inflation. They should be likewise aware of future policy actions. Forward-lookingness of economic agents is also related to their ability to form accurate forecasts. Thus, similarly to Łyziak and Mackiewicz-Łyziak (2014), we incorporate the analysis of expectations error in our examination. The implementation of inflation forecasts targeting, being a crucial point of our examination, offers a natural opportunity to reveal information that clearly guide economic agents' expectations. As a result, if a central bank implements IFT consistently, private forecasts (expectations) could be more aligned to an actual policy outcome and more accurate. In this study, we perceive IFT as a tool for shaping expectations.

The research covers the Czech Republic, Hungary, Romania, Poland, Sweden, and the United Kingdom. The time span is 2001-2016, but in some cases, it is shorter due to inaccessibility of relevant data. The countries under consideration are European economies with independent monetary policies, held under the inflation targeting regime[3]. This means that their central banks acknowledge the impact of expectations on monetary policy effectiveness and they search for the best way to shape them. To check if it is possible to relate expectations' forward-lookingness to central banks' involvement in IFT we selected a limited number of countries operating under similar monetary regimes. For these countries, we have at our disposal a methodologically consistent database containing the results of surveys on consumers' expectations. However, we do realise that the countries in our sample differ with respect to economic outputs and structures. Thus, greater

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[3] We have excluded economies with independent monetary policies that are focused on stabilization of the exchange rate. We conducted preliminary research for Bulgaria and Croatia: hybrid specifications of expectations had poor properties.

forward-lookingness of expectations may be related to other factors than central banks' involvement in IFT or their forward-looking transparency. As a result, we do not interpret our findings in terms of causality.

We focus on consumers' expectations as their choices are decisive for the economic output. The existing research outcomes usually apply to professional forecasters. The examination of the associations between the expectations and central banks' forecasts, which are actually quite scarce considering the importance of the problem, did not provide unambiguous responses to possible interrelations. That is why we had decided to address this matter again by applying an indirect approach to the problem.

Our methodology covers six steps. Firstly, we quantify Business and Consumer Survey data with the use of the Carlson and Parkin method to obtain consumers' expectations proxies. Secondly, we analyse expectations errors for our sample. Thirdly, we conduct standard tests of expectations unbiasedness and of their orthogonality to reject the rational expectations hypothesis. Fourthly, knowing that the rational expectations hypothesis does not hold for our data set, we assess econometrically the forward- and backward-lookingness of expectations in the six countries. Fifthly, we calculate for these countries the index of IFT implementation and transparency in the field of forecasting and then compare the results. Sixthly, we assess dependencies between expectations errors and central banks involvement in IFT.

The novelty of our examination rests in the methodology used. First, we apply an index of inflation forecasts targeting, which helps to evaluate the central banks' involvement in this well-recognised procedure. Moreover, we use an index of forecasting transparency (a sub-index of the IF index). Secondly, we discuss IFT jointly with forward-lookingness of expectations, which – to the best of our knowledge – has not yet been presented in economic literature.

The paper includes a literature review section with theoretical and empirical findings on expectations and their forward-lookingness, and on central banks' forward-looking communication. The literature review supports our assumptions and methodology. The next section focuses on methodology. It presents subsequent steps of our research procedure. The methodological part is followed by the section explaining the results and their interpretation. Finally – we conclude the paper with our findings.

2. Literature review

The role of expectations in the monetary policy is widely acknowledged in economic literature (Woodford, 2003), just as the framework of inflation targeting (IT) is considered to be the best way to implement theoretical assumptions (Bernanke et al., 2001). Neither the modern economic theory nor the strategy

was discarded after the outbreak of global crisis, even if the critics of both grew in numbers. Explicit commitment to quantitative inflation targets with other arrangements resulted in the high degree of stability of medium-run expectations during the crisis (Woodford, 2014). Inflation targeters may combine inflation stabilization with some degree of output stabilization. Still, however, they should remain focused on inflation. It can be captured by an empirical analysis of reaction function (as presented, i.a., by Ryczkowski (2016)).

Producing and revealing inflation (and macroeconomic) forecast is an immanent part of IT. If the forecast serves as an input to the deliberations of the Monetary Policy Committee (MPC), and if it is published, it can then enhance monetary policy forward-lookingness and the FL of economic agents' expectations. Eventually, IFT implementation ensures central banks' minimisation of loss function. The relevant literature presents numerous approaches to IFT adjusted to the maturity of the monetary policy (Svensson, 1997; 2005; Woodford, 2012; Gersbach and Hahn, 2014).

The economic mechanism that remains in the background of the impact of central banks' forward-looking communication on expectations describes how the expectations-oriented frameworks of IT should stabilise private forecasts, namely expectations, on the inflation target level. The numerically announced inflation target, together with the prioritisation of its achievement, should *ex ante* stabilize expectations on the target level. Moreover, it should constitute a nominal anchor for the price level and expectations (Bernanke et al., 2001). Previous research provides evidence that inflation targeting works: long-run inflation expectations are anchored to the target (Gurkaynak et al., 2007) and they were stable even during the most turbulent times (Woodford, 2014). Nevertheless, expectations anchored to the target stand for central banks' credibility and only to some extent – forward-lookingness of expectations. It is not enough to establish a nominal anchor for the medium and long-term periods to obtain stable and anchored expectations. First of all, the monetary policy horizon is at least medium-term. Thus, it is insufficient to promise that the goal would be achieved in the far-away future. Short-term expectations (which are covered by this research) are more volatile and heterogeneous (Fukač, 2010).

Given that the perfect alignment of expectations to inflation target does not occur for several reasons, the alternative option is the alignment of expectations of the public to the central banks' expectations and its future policy. IFT, which involves economic transparency, communication and signalling of the central bank's actions, is an option that supports expectations' FL. Forecasts produced for the entire monetary policy horizon can align private forecasts to the policy outcome for a shorter horizon than the monetary policy horizon, especially when the target is temporarily missed (Skořepa and Kotlán, 2003). Private agents may be aware that it is not possible to achieve the inflation target for some time, but instead they have a clear reference for the nearer future (the forecasts). The literature presents evidence

that even imprecise inflation forecasts have an impact on expectations (Crowe and Meade, 2008; Ehrmann et al., 2012).

Secondly, IFT means more than just the publication of forecasts. It integrates forecast-related assumptions and the central bank's view on monetary transmission (forecasting model). In such a situation, we can discuss economic transparency, which, according to Geraats (2002) taxonomy, relates to data, models, and forecasts. The publication of information underlying a forecast, together with the regular publication of the forecast itself, may have both information effect and incentive effects for private forecasts. The first one refers to the consequences of revealing some information, the latter – to an *ex ante* structural change in economic behaviour due to the different information structure (Geraats, 2014). Information effect is reflected in the fact that forecasts do not present a perfect situation of the inflation rate meeting the inflation target, but an economic output of the economy affected by shocks. The public may find out how the shocks impact on the economy in the nearest future while reading forecasts. Private forecasts benefit from lower forecast errors (lower deviation of expectations from the actual inflation). Thirdly, the incentive effect of forecast publication on expectations is also related to the situation of the shock occurrence. As forecasts reflect an anticipated shock, the central bank can become more engaged in economic stabilisation without de-anchoring long-run expectations (Geraats, 2013). The public, assuming that it is aware of the shock, gives more room to the central bank's actions without changing long-run expectations, but having short-run expectations more consistent with policy actions.

The effect of the publication of forecasts on forward-lookingness of expectations can be discussed in terms of an incentive contract for central bankers as proposed by Gersbach and Hahn (2014). The contract relates central bankers' remuneration to the accuracy of bank's forecasts and thus contributes to accuracy improvement. The authors introduce to the standard New-Keynesian framework (which minimises the standard social loss function) the deviation of inflation forecasts from the actual inflation. Under such a regime, central banks prepare inflation forecasts for the next period, in addition to standard policy settings, as their instruments. The existence of a preannounced inflation forecasts contract makes it possible to increase (lower) inflation expectations by increasing (lowering) the next period forecast because the public knows that the deviation of future inflation from today's forecasts will generate costs for the central banker. As central bankers are motivated to produce the most accurate forecasts and provided that the public thinks it is reasonable to follow them while developing private forecasts, these forecasts – namely expectations – should be more future-oriented than in the case where there is no preannounced inflation forecasts contract.

Finally, the publication of macroeconomic forecasts and a forward-looking analysis is beneficial in terms of interfering future policy actions by the public. Having an idea of policy accommodation facilitates the alignment of expectations. Economic

transparency reduces uncertainty of policy outcomes, while the explicit reference to forecasts may be the most concise and convincing explanation of policy actions. Under the inflation targeting regime, inflation or a macroeconomic forecast can be perceived as an intermediate target and indicate the policy track (Svensson, 1997). The forecast publication, accompanied by some description of forward-looking factors assessment, and the actual alignment of the central bankers' decisions with the forecasts might be reflected in the rationale behind central banks' decisions and in their minutes and, thus, become an effective communication tool.

The publication of inflation forecasts, which is the most important part of forward-looking communication that we deal with in this article, should align expectations of economic agents. Several authors have undertaken to conduct empirical verification of such a relation (see: Ehrmann et al., 2012; Hubert, 2015; Pedersen, 2015; Szyszko and Płuciennik, 2018). These examinations cover a variety of countries and methodologies. The most general conclusion drawn on their basis is that central banks' forecasts have an impact on expectations.

To summarise the previous findings related to our research question, we conclude that the number of relevant studies is not high. The methodology varies from the simplest approaches to quite sophisticated ones. Moreover, regardless of the methodology used, authors remain cautious while interpreting results. More and more research is produced to assess the central banks' strategy or the general impact of transparency on expectations or their dispersions. Most research projects cover the forecasts of professional forecasters instead of the forecasts of consumers. Finally, we should mention that the majority of the relevant studies is carried out for developed economies. In this paper, we apply a novel approach, which is indirect and which combines some results of the properties of tests of expectations with the index-based approach.

3. Methodology

In this study, we apply a combined methodology, which is a mixture of qualitative and quantitative methods. The former group involves the index-based assessment of forward-looking communication and the evaluation of its relation to the degree of forward-lookingness of consumers' expectations. The latter covers quantification of expectations, tests of rationality, correlation analysis, and estimations of hybrid specification of expectations. Our six-step procedure is described in detail below. It covers:

(1) Quantification of consumers' expectations,

(2) Forecasts accuracy examination,

(3) Tests for the rationality of expectations: unbiasedness and orthogonality,

(4) Estimations of hybrid specification of expectation,

(5) Index-based inflation forecast targeting assessment,

(6) Correlation analysis (IFT vs. expectations accuracy).

At first, consumers' expectations are examined in the qualitative surveys. Respondents are asked the following question: *When compared to the past 12 months, how do you expect consumer prices to develop in the next 12 months?* And the answers to choose from: *They will…increase more rapidly, increase at the same rate, increase at a slower rate, stay about the same, drop, don't know* (EC 2016). The research commences with their quantification. We apply the standard Carlson and Parkin (1975) probability approach, adjusted to five-question surveys by Batchelor and Orr (1988). Assumptions and equations describing the procedure are presented in Appendix (see Figure A1 and description below it). When the Carlson and Parkin quantification procedure is applied, an assumption concerning the scaling factor should be made. In this examination, we have considered that (*i*) consumers refer to the most recently announced inflation figure that they are aware of (objectified version); and alternatively (*ii*) they refer to their inflation perception (subjectified version). The latter means that we double the quantification procedure because, at first, we quantify the consumers' inflation perception. The survey's question on perceived inflation is: *How do you think that consumer prices have developed over the last 12 months?* And the answers to choose from: *They have... risen a lot, risen moderately, risen slightly, stayed about the same, fallen, don't know* (EC 2016).When perceived inflation is quantified, a scaling factor that represents average inflation is also needed. In this study, we have used the moving average of past inflation as a scaling factor. Moreover, Łyziak (2013) proposes the correction of the method applicable for deflation periods that had been recorded in the three countries in the sample.

Secondly, we have analysed absolute median errors of expectations. Minor errors of expectations indicate that expectations are more convergent with actual policy actions and outcomes, and thus: forward-looking. In our analysis of forecasts accuracy, we refer to median errors to diminish the impact of outliers on the results. We have also used absolute errors as we do not aim at discussing how the expectations diverge from actual inflation.

The third step of our procedure covers standard tests of expectations rationality, which include unbiasedness examination (Eq. 1) and tests of macroeconomic efficiency (Eq. 2 and 3)[4]:

$$\pi^e_{t|t-12} = \alpha + \beta\pi_t + \varepsilon_t \qquad\qquad (1)$$

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[4] Equations presented by Łyziak (2014). The same procedure broadly applied by other authors.

where: $\pi^e_{t|t-12}$ is expected at time t inflation rate formed 12 months earlier, π_t is actual inflation at period t, and ε_t is white noise error. We test H0: $\alpha = 0$ and $\beta = 1$. If it holds, expectations are unbiased: equal to actual future inflation on average, and to actual future inflation corrected by a random forecast error, period by period. It means that they are free from systematic errors.

The macroeconomic efficiency tests are applied to verify whether consumers take into consideration all relevant available information when forming their expectations. If they formed rational expectation, they would do so.

$$e_t = \alpha_0 + \alpha_1 \Omega_t + \varepsilon_t \tag{2}$$

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

where $e_t = \pi^e_{t|t-12} - \pi_t$ is expectation error and Ω_t is macroeconomic variable affecting inflation. We test H0: $\alpha_1 = 0$. Macroeconomic efficiency does not occur when $\alpha_1 \neq 0$. It means that consumers do not process available information efficiently while forming their expectations. If they incorporated a wider information set, their expectations errors would not be related to available information about inflation drivers.

The tests expectations rationality must precede the analysis of the hybrid nature of expectations: if the expectations were rational, estimations of their forward-lookingness would not be justified. Bearing in mind the auxiliary character of the tests for unbiasedness and orthogonality, we decided not to offer their extended descriptions. In order to test orthogonality, we used the macroeconomic variables presented in Table 2.

Specification of the hybrid nature of expectations involves estimation of Eq. 4 and Eq. 5 (we test H0: $\alpha_2 = 1$). It is the fourth step of our examination. Notations used in previous equations still apply.

$$\pi^e_{t+12|t} = \alpha_1 + \alpha_2 \pi_{t+12} + (1 - \alpha_2)[\pi^e_{t-2|t-14} + \alpha_3(\pi^e_{t-2|t-14} - \pi_{t-2}) + \alpha_4(\pi_{t-2} - \pi_{t-14})] + \varepsilon_t \tag{4}$$

$$\pi^e_{t+12|t} = \alpha_1 + \alpha_2 \pi_{t+12} + (1 - \alpha_2) \pi_{t-2} + \varepsilon_t \tag{5}$$

Equation (4) presents a mixture of forward-looking and adaptive expectations, whereas equation (5) incorporates the forward-looking and the static approach. Backward-looking parts of our equations present theoretical models of adaptive or static expectations. Adaptive specification relates expectations to its past values, corrected by past expectations errors. Additionally, it incorporates a possible impact of a change in the current inflation on inflation expectations. Static specification relates backward-looking component only to past inflation. In both equations, α_2 represents the degree of forward-lookingness – the rational component of expectations.

In Eq. 4 and 5 we consider $\pi^e_{t+12|t}$, which is expectations formed at period t for 12 months ahead. This choice is aligned to the horizon of expectations examined by Business and Consumer Survey (the question presented at the beginning of Methodology section). However, as far as consumers are considered, we applied the information lag of 2 months. Such a lag is considered once we determine the scaling factor for quantification of expectations. We also applied it for both hybrid specifications of expectations ($\pi^e_{t-2|t-14}$, and π_{t-2}). It simply means that consumers refer to the latest inflation figure that *they could be aware of*. The two-month lag (or 1Q for quarterly data frequency) is a standard assumption here. In period t, inflation rate from $t-1$ is published. Moreover, the survey held at t may precede the publication of inflation rate from $t-1$. Thus, a lag of one month is not enough. The information lag consideration is a standard procedure while examining consumers' expectations (Geberding, 2001; Łyziak, 2014; Dräger, 2015).

In case of Eq. 4 and 5, we must deal with the endogeneity problem. What it means is that changes in regressor are associated not only with changes in dependent variables, but also changes in the error terms, which make OLS inconsistent. To deal with that, we use the instrumental-variables regression: the two-stage least squares (2SLS) estimation method. In this method, "in the first stage" we calculate an auxiliary regression with all of the available instruments included as explanatory variables. The predicted values of that regression will serve as the instrument for "the second stage". The instrumental variables estimator provides a method of obtaining consistent estimates of the parameter. The inflation rate, with its lag values, (up to 12 lags) is our instrument here. To ensure unbiased parameters and a valid instrument, we apply the diagnostic tests: Wu-Hausman test for OLS consistency (Hausman, 1978), Sargan test for instrument exogeneity using overidentifying restrictions (Sargan, 1958), and weak instruments test (Stock and Yogo, 2005). To produce robustness results, we use heteroscedasticity-autocorrelated consistent estimator (HAC) and report the heteroscedasticity-corrected standard error.

We re-estimate our models using GMM to check the robustness of our estimates of the degree of expectations' FL. Having obtained estimations of hybrid specification of expectations with the GMM estimator, we run tests for the existence of statistically significant differences of both estimations using Z-test according to Paternoster et al. (1998).

Table 1: IFT index aspects and points attribution scheme

	Aspect	Options/points		General description
Forecasting methodology	Forecasting model	0 ½ 1	not published general or partial description published	Points are attributed for forecasting model's publication in any central bank's document. Full description covers revealing parameters of the model
	Assumptions	0 ½ 1	not discussed partially published or revealed without replicable pattern published	The way of presenting forecast assumption: information set relevant for forecasting from the CB perspective
Declara-tion	Forecast importance for the MPC	0 ½ 1	none not explicitly yes	Publicised information on the forecast role in monetary policy
	Forecasts ownership	0 1	central bank's staff MPC	Describes the MPC's involvement into forecasting procedures and forecasts approval
Publication	Regularity	0 1	no yes	Publication schedule regularity in subsequent years
	Frequency	0 ½ 1	once a year 2-3 times per year at least quarterly	Frequency of publication: more forecasts per year is better than less; as the forecasts become stale
	Central path of inflation	0 1 2	not published descriptively numerically	The most important information revealed. "Descriptively" means forecasts publication on the fun chart, without numerically expressed central path of inflation
	Policy path	0 ½ 1	not published descriptively numerically	Description or explicit presentation of the next forecast-consistent change of interest rates
	Risk analysis	0 1	not published referred to	One point is attributed in the case of any reference to the forecast's risk
Actual practice	Decision compatibility	0 1 2	none partial yes	Information with the highest weight. The way of compatibility assessment depends on the forecast (un)conditionality
	Decision timing	0 1	decision made when the forecast is produced in subsequent months	Forecasts produced with lower frequency that the MPC's meetings. Timing is a detector of forecasts input into decision-making
	Forecasts in decision's rationale	0 ½ 1	not presented only main part of the forecasts described forecast-oriented minutes	Reference to forecast in decision rationale/ minutes. When forecasts description dominates, 1 point is given
Ex post analysis	Past forecast assessment	0 ½ 1	not presented one out of two possibilities both descriptions	Reference to past forecasts errors or a comparison of two subsequent forecasts. Enhances understanding of shocks occurring in the economy and CB reaction for shocks

Notes: CB: central bank, MPC: monetary policy committee

Source: (Szyszko, 2017), index and its description modified by authors as explained in the above table.

At the fifth stage of the examination, we use an index of inflation forecast-targeting implementation (Szyszko, 2017) in order to assess the central bank's commitment to IFT implementation (Table 1). With the index, we can assess whether the central bank implements the inflation forecast targeting: it checks the transparency of forecasting systems and the monetary policy committee's consistency in following the central bank's forecast message. The index covers five aspects of IFT. It starts with the analysis of forecasting methodology (i). When the central bank publishes the model it applies, it reveals the framework of its decision-making and its point of view on transmission mechanism. Rational expectations formation needs no asymmetry of information, also regarding the perception of how the economy works. Publication of forecasting methodology might reduce such an asymmetry.

The second aspect covered by the index is related to the central bank's declaration on the role played by forecasts in its monetary policy (ii). Once it is declared, it shortens the time of expectations adjustment to new communication. If an important role is attributed to the forecasts a priori, it opens the field for treating the forecast as an intermediate target. However, it also makes it possible to test whether the forecast is actually an input for decision-making to the extent that was promised. We add an additional criterion to the assessment of the central bank's declaration: the forecast ownership. It is often analysed as one of the features of forecasting systems (Hammond, 2012). Once a decision-maker becomes explicitly involved in forecasting procedures and assumes responsibility for the final outcome, it is more likely to conduct a forecasts-oriented policy. Consistency in the central banker's behaviour facilitates the formation of expectations.

The third aspect of the index relates to the publication of forecast results (iii). To align inflation expectations to actual policy actions or to become intermediate target (for the central bank and under public control) the forecast should be disclosed regularly, in line with a pre-announced schedule, in a way that enables its straightforward interpretation. That is why the publication of the central path of inflation (the most probable evolution of inflation rate) together with a forecasts-consistent path of interest rates (policy path) offers the most as regards the formation of rational expectations. Previous examination suggests that marginal benefits from publishing the central path of inflation are higher than from publishing the policy path (Brzoza-Brzezina, Kot 2008). Moreover, since publications of central paths are the most important information about future economic outcome that may affect expectations, they are attributed 2 points, whereas standard – 1 point at maximum.

The fourth aspect of the IFT index refers to the actual IFT implementation (iv). It captures whether the central bank's behaviour consistently follows its forecasts and its declaration on the role of forecasts in policy-making. For consistent, forecasts-based decision-making processes, more points are attributed (two instead of 2 at maximum). The criterion of decision compatibility with forecasts reflects central bank's involvement in IFT. If the index is calculated without taking this component

into consideration, it represents central bank's transparency in forecasting, which we also comment on while interpreting results (IFT_{trans}).

Finally, the fifth aspect of IFT (v) assesses the central bank's self-reference to its past forecasts (forecast accuracy and the differences of subsequent forecasts). Overt ex-post evaluation enhances understanding of shocks it the economy.

The sixth step of the examination is a joint analysis of the IFT index values and expectations. For each economy, we examine non-parametric correlations of the IFT values and expectation errors. We use non-parametric measures of associations due to the character of time series: the IFT value is not a continuous variable. The Spearman and Kendall correlation coefficients are suitable for a situation where the data are in the form of ranks or are on an ordinal scale. Under a null hypothesis, there is no monotonic association between inflation forecast results and expectations, or the two variables are independent for $\alpha = 0.05$.

The forecasts are produced with lower frequency than the surveys on expectations are conducted; therefore, we repeated the value of the IFT index for subsequent months following the publication of forecasts – until the publication of the next forecasts. Correspondingly to previous steps of examination, we assumed a two-month information lag: we confronted the IFT index value for period t with inflation expectations (or their errors) for $t+2$. Even if we did not test the causality of our variables, we remembered that the central bank's forward-looking transparency and its involvement in IFT may affect expectations. Thus, the information must precede the reaction. To check the robustness of the results we conducted examinations for two measures of correlation and also for longer information lags.

Finally, to confirm our hypothesis on the relation of central banks' forward-lookingness (expressed in their involvement in IFT) and forward-lookingness of expectations, we have analysed:

(1) An average degree of expectations' FL and an average degree of central bank's involvement in IFT for each country; we expect to find higher degree of FL for countries where an average IFT index is a higher value,

(2) Average expectation errors and an average IFT index value to find whether central bank bigger involvement in IFT is reflected in lower, on average, expectations errors,

(3) A dependence of expectation errors and the IFT index values; we expect them to be statistically significant and negative: more FL information revealed means more accurate forecasts,

(4) After a one-by-one analysis for points a)-d) we present a cross-country comparison.

4. Empirical data and analysis

In this section we provide the details on our sample, including the presentation of expectation's quantification outcomes, followed by the estimations of hybrid specification of expectations. We also deliver the outcomes of statistical and econometrical procedures as well as index-based estimations of FL transparency. The extended economic interpretation of the results is provided in the next section.

Table 2: Sample and the data

Member State:	CZ	HU	PL	RO	SE	UK
Research period[*]	1/01-12/16	1/01-12/16	05/01-112/16	08/04-12/16	1/01-12/16	1/01-12/16
Number of observations	192	192	188	156	192	192
Number of forecasts	64	61	40	46	88	64
Scaling factor[**]	No	No	Yes	Yes	Yes	No
Forecast	Inflation Reports or equivalent documents					
Expectations	European Commission Business and Consumers Surveys; fractions of responses on qualitative questions; monthly data					
Macroeconomic indicators	Central banks and national statistical offices. Monthly data for inflation, unemployment, industrial production index, broad money. Daily quotations of exchange rates (vis-à-vis EUR and USD) and 3M interbank offer rates averaged (simple averages). Used to tests macroeconomic efficiency of expectations. Needed for macroeconomic efficiency tests: Ω_t – in Eq. 2 and 3.					
Oil prices	Macrobond. Brent oil. Monthly averages of spot prices. USD per barrel. Used to tests macroeconomic efficiency of expectations. Needed for macroeconomic efficiency tests: Ω_t – in Eq. 2 and 3.					

Note: [*] 2001-2016 is the basic time span of the research. It is shortened for PL and RO due to time series accessibility. [**] Inflation expectations quantified with the scaling factor procedure for deflation episodes.

Source: Authors

The details of the sample description are given in Table 2. It describes the sources of our data and basic data pre-treatment. Additionally, a country-specific research period is presented and the information on the necessity of applying the scaling factor procedure due to the prolonged episodes of deflation in the countries under analysis. The number of observations refers to the months with respect of which we are able to quantify expectations. It is the same for macroeconomic indicators that we use to test the orthogonality of expectations. The number of forecasts is presented separately. It is lower than the number of observations as the central banks provide the public with 3-6 forecasts per year. A standard forecasting round lasts a quarter. The National Bank of Poland produces three forecasts per year and

the Sveriges Riksbank (the central bank of Sweden) – six. Thus the number of forecasts differs substantially across countries.

Table 3 shows descriptive statistics of our raw data presenting expectations properties and p-value of an augmented Dickey-Fuller test (ADF) with the null hypothesis (a unit root is present in a time series sample). Three samples are not stationary, so in this case the models were estimated for the first differences.

Table 3: Properties of expectations

	CZ		HU		PL	RO		SE		UK	
	O	S	O	S	O	O	S	O	S	O	S
Mean	1.98	1.42	4.77	5.06	2.06	5.43	8.27	1.24	1.09	1.76	1.65
Median	1.94	1.32	4.69	5.31	1.95	4.92	6.78	1.08	1.10	1.59	1.41
Minimum	-0.20	0.63	-0.57	0.59	0.02	-0.03	0.70	-0.03	0.73	0.35	0.99
Maximum	5.11	3.16	12.63	10.23	6.53	15.32	30.68	3.65	1.63	3.95	3.02
Standard deviation	1.24	0.53	3.14	2.38	1.49	3.78	6.11	1.01	0.19	0.85	0.63
Skewness	0.57	0.94	0.24	-0.14	0.44	0.28	1.28	0.48	0.13	0.58	0.69
Ex. kurtosis	-0.33	0.47	-0.58	-0.45	-0.36	-0.76	1.78	-0.80	-0.31	-0.19	-1.04
ADF test	0.02	0.09	0.01	0.05	0.01	0.01	0.01	0.09	0.51[*]	0.37[*]	0.55[*]

Note: O – objectified version of quantification; S – subjectified version of quantification, for Poland, Business and Consumer Surveys do not include the question on perceived inflation. Thus only the objectified version is analysed. [*] Unbiasedness and orthogonality were estimated on first differences; in Eq. 4 and 5 specifications, dependent variable was the difference of expectations and lag 2 expectation (Eq. 4) and lag 2 inflation (Eq. 5). Thus, all-time series were stationary.

Source: Authors, based on the quantification procedure of the Business and Consumer Surveys which included questions on perceived and expected inflation results.

The inflation expectations quantified with both methods and confronted with actual inflation are presented in Appendix (Figures A2-A7). Generally, quantified expectations are close to past inflation. They mimic its developments and only in some cases which occurs for a short period – they precede inflation. All of this suggests the existence of a strong backward-looking component in inflation expectations. The Romanian case is a clear example of the latest history of high inflation: as deflation process has ended recently in Romania, an objectified version of expectations quantification where public's perception of an average inflation rate in the past is a scaling factor remarkably exceeds subjectified expectations, especially at the beginning of our research period. The evolution of objectified expectations for Sweden – extremely smoothed expectations throughout the entire research period – may be explained by the historically low inflation development

and the central bank credibility: the outburst of the crisis did not affect inflation perception to a significant degree. In the UK, objectified expectations had been smoothed only until the arrival of the most recent crisis. Increased inflation volatility affected much more significantly the structure of answers provided to the survey questions.

The second step of the research points out that mean errors (Table 4) of expectations are lower in the countries that perform better in terms of inflation. It confirms that past inflation exerts strong impact on expectations. Expectation errors will be confronted with an average IFT index values while concluding.

Table 4: Abridged results: forward-lookingness and IFT implementation

Country	CZ		PL	RO		HU		SE		UK	
Expectations	O	S	O*	O	S	O	S	O	S	O	S
α_2**	0.19	0.11	0.14	--	--	--	--	0.36	--	0.55	0.24
R^2	0.93	0.47	0.91	--	--	--	--	0.91	--	0.15	0.68
Expect. errors	1.06	0.86	1.16	2.55	3.96	1.90	1.76	0.91	0.96	0.75	0.94
ρ	-0.22 (0.00)	-0.42 (0.00)	-0.27 (0.00)	-0.24 (0.00)	-0.34 (0.00)	-0.10 (0.20)	-0.05 (0.54)	0.13 (0.96)	0.18 (0.02)	0.00 (0.96)	-0.08 (0.29)
τ	-0.17 (0.00)	-0.29 (0.00)	-0.21 (0.00)	-0.18 (0.00)	-0.25 (0.00)	-0.07 (0.19)	-0.03 (0.53)	0.09 (0.98)	0.13 (0.01)	0.00 (0.98)	-0.06 (0.29)
IFT		0.88	0.52 [0.64]	0.58 [0.63]		0.67		0.89		0.71	
IFT$_{trans}$		0.89	0.57 [0.75]	0.62 [0.68]		0.82		0.88		0.71	

Note: * only objectified version of expectations is presented due to the data accessibility; -- denotes purely backward-looking expectations; ρ – Spearman correlation coefficient, τ – Kendall's tau coefficient; p-values in parentheses. Numbers in brackets for Poland and Romania present index value for shortened horizon. Details presented below.

Source: Authors

The third step of the research rejected rationality of the examined expectations. Since we actually did reject it (see Appendix, Table A1 and A2), the third step of the research is validated. We do not discuss the results of the rationality examination as this step of the research is auxiliary and the length of the article is limited.

Table 4 presents the abridged results of the forward-lookingness estimations and average values of IFT/IFT$_{trans}$ indices, mean absolute errors of expectations, as well as the outcomes of the correlation analysis. Thus, it presents the results of steps 4-6 of our examination. For forward-lookingness we have chosen to present the α_2 and R^2 of the hybrid equation with better goodness-of-fit. In most cases it is an adaptive specification (Eq. 4). Full estimations and diagnostic tests are presented in

Appendix (Table A3). The estimation results are robust on the estimation method applied. Robustness tests are also presented in Appendix (Table A4).

For Poland and Romania we present two averages values of IFT/IFT$_{trans}$. The first one is calculated for the entire period of examination: since May 2001 for Poland and since August 2004 for Romania. The central banks of Poland and Romania started to publish their forecasts after the surveys had been launched. The second value of the index (in brackets) is calculated only for the period when the forecast is published: since August 2004 for Poland and August 2005 for Romania. It is greater that the first value, as the index values in months that preceded the forecast publication were 0.

The IFT index and the forecasting transparency index (average values in Tab. 4, evolution presented in Appendix, Figures A8-A13) are the highest for the Czech Republic and Sweden. The Czech Republic and Sweden are the most transparent inflation forecast targeters worldwide as they are in a group of several countries which publish transparent forecasted policy paths of the monetary policy. The index for the UK shows its less consistency in IFT implementation and less FL transparency. It stabilised since 2012. The Bank of England remains reluctant to endogenize and publish its interest rates. The IFT index for Hungary is also moderated. The lowest indices values for Poland and Romania – in comparison with the rest of the sample – can be partially explained by the fact that in their cases at the beginning of the research period the IFT/IFT$_{trans}$ equalled 0 – the forecast was not revealed.

5. Results and discussion

While interpreting our results, we focus on the analysis of forward-lookingness (Tab. 4) and its relation to the central banks' FL transparency in order to discuss our research hypothesis.

The starting point for the interpretation of the results of expectations' forward-lookingness is the case of Hungary and Romania (Tab. 4). We did not find any forward-looking component in the formation pattern of expectations among Hungarian and Romanian consumers. The failure to find an FL component in these two countries is, in our opinion, consistent with the monetary policy performance there. In general, they both implement inflation targeting similarly to the rest of the sample. Actually, inflation targeting implementation was the starting point for creating the sample. In contrast to the remaining four countries, the monetary policy of the National Bank of Hungary (NBH) and the National Bank of Romania (NBR) changed a lot during the research period.

Until February 2008, the NBH had conducted an eclectic monetary policy: fluctuation of the Hungarian forint exchange rate was typical of the pegged

exchange rate with the horizontal bands regime. The NBH intervened significantly to keep the exchange rate within the bands even when its reactions in opposition to the inflation goal achievement. In 2003, the Hungarian currency suffered from some speculative attacks and the MPC's decisions supported the currency on a number of occasions. But the search for the forint stabilisation ended up with the abandonment of the pegged exchange rate in 2008. Additionally, during the research period, the NBH lowered its inflation goal from 8% to 3% which had been applied since 2007. Previous research also suggests that Hungarian consumers remain strongly backward-looking. This upward shift of consumers' expectations from the inflation target is remarkable in Hungary even if cross-country comparisons are discussed (Gabriel, Rariga, & Varhegyi, 2014).

The NBR adopted inflation targeting in 2005, so the first year of the research period covers the monetary aggregate targeting regime. The first forecast was revealed in August 2005 (prior to this date the IFT index equalled 0). After the switch of the regime, the process of disinflation was enforced, but it was intermittent as some higher inflation episodes intertwined with the lower inflation periods. The inflation goal was lowered from 8% to 2.5% in 2013. Inflation volatility in Romania is the highest in our sample.

For Romania and Hungary we registered the highest values of expectation errors which could be due to retrospective adjustment of expectations to its past high values and inflation volatility. Additionally, we captured no statistically significant dependence of IFT and expectation errors in Hungary. The IFT index value hardly evolved over time in Hungary. However, in Romania its value changed during the research period and we captured weak interdependence between expectations and forward-looking monetary policy (expressed by the IFT index values).

We consider the modifications of monetary frameworks in both countries to be structural changes in their monetary policy. They could considerably affect the formation of expectations and the learning process of the economic agents. They also affect some factors which are not covered by this study, such as credibility of monetary policy. Despite the relatively low value of the IFT index in Hungary and Romania, we find the changes in the monetary policy and economic condition to be the explanation for purely backward-looking expectations. Nonetheless, both factors (lower commitment to IFT and monetary policy changes) interfere with each other. While establishing the time span of the research we decided to cover the entire period for which the surveys on expectations are conducted, but in the case of Hungary and Romania no associations could be found for the whole sample[5].

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[5] FL of expectations appears in both countries when the sample starts in 2011.

The results for the four remaining countries are more obvious to interpret[6]. The forward-lookingness of objectified consumers' expectations in these countries varies from about 14% for Poland to about 55% for the UK[7]. These results do not diverge from other research results. The results for the quantification of subjectified expectations are not discussed as we captured any degree of FL for α_2 significance at 0.05 only for two countries. The models for the subjectified version of expectations offer poorer estimates.

We capture some differences in consumers' FL between the economies in transition and the developed ones. We had expected this: the developed economies have made fewer structural breaks in the monetary policy recently. The consumers in these economies have had enough time to learn how the monetary policy is conducted. It is also confirmed by lower mean errors of expectations for the developed economies. The effectiveness of monetary policy is better – in terms of the goal achievement. At the same time, they are much more experienced in IT and IFT implementation. We expected that developed economies would be a benchmark with higher IFT involvement and higher degree of forward-lookingness of expectations. On the other hand, Sweden and the UK implemented extraordinary actions to curb the consequences of the recent financial crisis. It might have modified the formation of expectations and their FL.

While analysing the evolution of the forward-looking transparency we refer to the average values of IFT (Table 4) and their evolution (Figures A8-A13). The changes of the IFT index values need to be commented on. They occur throughout the entire research period. They are related to the fact that the content of Inflation Reports (or equivalent documents) vary throughout the year. Some central banks produce reports with full information every 6 months and offer shorter forecast updates between these publications. In some cases, the first quarter report contains more information (as the forecast assessments from the preceding year). The irregularity in the evolution of indices is also related to the index that we presented. This refers not only to the revealed information, but also to the significance of forecasts in decision-making processes. In some cases, the forecasts were a driving factor for policy makers (which is reflected in minutes and the decision itself), while sometimes other factors played a decisive role. As the extent of the revealed information is dominating in the IFT index composition (60%), it can be noticed that an increased index value stemmed mainly from increased transparency. There are only several exceptions to this, namely when transparency of the forecasting

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[6]   However, no forward-looking component was found for Sweden if the subjectified version of expectations was taken into account.

[7]   The goodness-to-fit of the hybrid specification of expectations which delivered this result was quite low. For subjectified expectations it was higher and the estimated degree of forward-lookingness was 0.24. It still accounts for high degree of FL in our sample.

system was limited in comparison to the previous periods. The consistency of decisions with forecasts was regular only in the CNB and the Sveriges Riksbank.

The differences between the IFT index and IFT$_{trans}$ are explained mainly by compatibility of the decisions made by central banks with its own forecasts. If central banks follow the message of the forecasts but fail to reveal a full set of information of forecasting system and procedures, the entire index value is higher than IFT$_{trans}$. In our sample, the opposite situation occurs: the consistency in forecast-based decision-making process is lower and a relatively high level of transparency is kept (the case of Poland). The NBP is the only case in our sample when the IFT index on the publication date of the first forecast was higher than at the end of our research period.

The joint analysis of forward-lookingness and IFT/IFT$_{trans}$ suggests that Swedish, Czech, and British consumers have the most transparent and forecast-oriented central banks and a high degree of expectations' FL. In the Czech Republic, FL was much lower than in Sweden and the UK, but still the result is quite high as for a transition economy. In countries without any FL component, the indices registered lower values than in the economies with the most forward-looking consumers. However, the degree of expectations' FL cannot be directly related to the central bank's commitment to IFT or more transparency of forecasting system. The Polish case (the lowest IFT index value and a relatively high FL component of expectations) does not fit the pattern.

In addition to providing an analysis of the average IFT index values and the degree of FL we provide an analysis of correlations between IFT values and expectation errors. As we have already mentioned they are not statistically significant for Hungary and for Sweden and the UK. This absence of such relation in the developed economies could stem from low forecast errors and quite stable central banks' involvement in IFT over time.

A general summary of the results is presented in Table 6. Our results suggest that central banks' forward-looking transparency and their commitment to IFT can create preferable conditions for a higher degree of forward-lookingness, especially when monetary policy is quite stable over a span of time. This study suggest is that a stable and expectations-oriented monetary policy framework is the first step towards more forward-looking expectations of consumers. It is easier to achieve a higher degree of forward-lookingness when episodes of high inflation are echoes of the past – which is exactly the case of developed economies in our sample. Another implication of this research is that extreme transparency of forward-looking actions, which can be understood as the publication of forecasts-consistent policy paths, does not necessarily transform into extreme FL of consumers. If so, the push towards greater transparency itself is not the easiest method to improve rationality of economic agents.

Table 6: Summary of results

Country	CZ	PL	RO	HU	SE	UK
Degree of FL	medium/high[*]	medium	none	none	high	high
IFT index	high	low	low	medium	high	medium
Mean errors	medium	medium	high	high	low	low
Dependence	medium	medium	medium	none	none	none

Note: [*] As the Czech Republic is a transition economy, the degree of consumers' FL is relatively high.

Source: Authors

This paper contributes to the literature on expectations as we have covered the most recent research period, and applied an indirect approach to verify the existence of the relation in question. We delivered the most up-to-date results of the analysis of expectations' FL and a coherent analysis of forward-looking transparency of six European economies. We also studied the relation between consumers' FL and the degree of central banks' involvement in IFT and its forward-looking transparency. We found some case-dependent relations which provide a forum for further examination on a larger sample.

5. Conclusion

The following paper provides an analysis of consumers' forward-lookingness of expectations in the light of central banks' consistency in the IFT implementation. We hypothesize that bigger involvement of central banks in IFT is the starting point for more forward-looking expectations (a higher degree of FL and more accurate expectations). We examined six countries: with respect to two of them we did not manage to estimate the level of FL due to some strategical changes in the monetary policy (which we call structural changes). In the case of the remaining four countries it is impossible to draw a simple conclusion that bigger involvement in IFT means a higher degree of FL. A joint analysis of IFT and FL could be summarised in the following way: in the economies where consumers' expectations are partially forward-looking, the degree of FL corresponds to a certain extent to the central bank's commitment to IFT implementation captured by the IFT index. We were able to confirm our hypothesis to some extent only: we recognise the importance of bigger involvement in inflation forecasts targeting and forward-looking transparency for consumers' forward-lookingness, but this is not the entire story.

To summarise the paper, we should mention that we confirmed non-rationality of consumers' expectations in the case of six countries. This study reaffirms similar

findings presented in abundant literature. But the question of the rationality of expectations is still posed by the researchers: with the change of economic circumstances, the monetary theory and practice change as well. Simultaneously, the length of the accessible time series is rising, which leaves space for further research.

We see the how the research can be elaborated on: 30 other inflation targeters are left out of the sample. Except for IFT implementation and forecast transparency, we can search for the explanatory factors for FL in central banks' effectiveness and their credibility.

Finally, we acknowledge that modern monetary policy is held under common institutional framework, but the central banks can create individual solutions on strategical and operational levels at their own discretion. It means that different approaches are applied towards inflation forecasts targeting and communication with the public. The evolution of our indices captures some portion of this difference. Unification of these procedures is neither possible nor advised. The story of affecting expectations of economic agents and the effectiveness of central banks' actions directed at expectations needs further research. Our study pertains to this research.

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Komponenta očekivanja potrošača usmjerena na budućnost i prognoziranje inflacije: slučaj šest europskih gospodarstava

Magdalena Szyszko[1], Aleksandra Rutkowska[2]

Sažetak

Budući da postoje različiti načini otkrivanja namjera središnjih banaka, pojavljuje se jednostavno istraživačko pitanje, koje se razmatra u ovoj studiji. Je li komponenta očekivanja potrošača usmjerena na budućnost povezana s načinom na koji središnje banke otkrivaju i koriste prognoze? Istraživanje obuhvaća šest zemalja: Češku, Mađarsku, Rumunjsku, Poljsku, Švedsku i Veliku Britaniju, u razdoblju od 2001. do 2016. godine. Naša metodologija sastoji se od kvantifikacije očekivanja, testova racionalnosti očekivanja, procjene stupnja njihove usmjerenosti na budućnost, indeksne procjene prognoziranja centralnih banaka o transparentnosti i važnosti prognoze u monetarnoj politici, kao i korelacijskog ispitivanja dalekovidnosti monetarne politike i pogreške očekivanja. Na temelju dovršenog istraživanja povezujemo rezultate analize usmjerenosti na budućnost s indeksnom procjenom ciljanog prognoziranja inflacije. Rezultati su različiti. Najviši stupanj usmjerenosti očekivanja na budućnost nalazi se u Velikoj Britaniji i Švedskoj. Očekivanja čeških potrošača su manje usmjerena na budućnost, dok je uključenost centralnih banaka u ciljano prognoziranje inflacije usporediva sa švedskim slučajem. Dvije zemlje nemaju komponentu usmjerenu na buduća očekivanja potrošača. Studija daje vrijedan doprinos postojećoj literaturi jer predstavlja novi pristup analizi odnosa između prognoze i ciljanog prognoziranja inflacije i očekivanja usmjerenih na budućnost.

Ključne riječi: *prognoza inflacije, ciljano prognoziranje inflacije, očekivanja potrošača, usmjerenost očekivanja na budućnosti*

JEL klasifikacija: *E580, E430*

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Appendices

1. Details of Carlson and Parkin Probability Approach

Figure A1: Assumptions for Carlson and Parkin Method
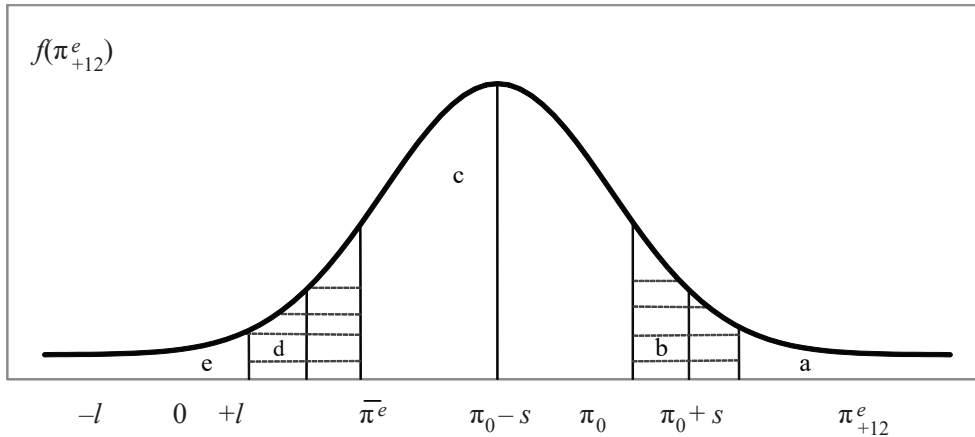
Source: (Łyziak 2010)

The assumptions of Carlson and Parkin method are shown in the figure above. The starting set of equations is presented below. Notations: $(-l,l)$ – sensitivity interval around zero (*prices will stay the same*); $(\pi_0 - s, \pi_0 + s)$ – sensitivity interval around scaling factor (*prices will increase at the same rate*); π^e_{+12} – expected rate of inflation, $f(\pi^e_{+12})$ – density function of expected inflation, $\overline{\pi^e}$ – expected rate of inflation, a,b,c,d,e – percentage of responders choosing one of the survey's responses: from the most positive (*prices will increase more rapidly*) to the most negative (*prices will fall*). The equations are rearranged according to the type of distribution: in this case, normal distribution of expectations is assumed.

$a = P(\pi^e_t > \pi_{0t} + s_t) = 1 - F_t(\pi_{0t} + s_t)$

$b = P(\pi_{0t} - s_t < \pi^e_t + < \pi_{0t} + s_t) = F_t(\pi_{0t} + s_t) - F_t(\pi_{0t} - s_t)$

$c = P(l_t < \pi^e_t < \pi_{0t} - s_t) = F_t(\pi_{0t} - s_t) - F_t(l_t)$

$d = P(-l_t < \pi^e_t < l_t) = F_t(l_t) - F_t(-l_t)$

$e = P(\pi^e_t < -l_t) = F_t(-l_t)$

Source: Based on Łyziak (2010).

2. Inflation expectations and inflation presentation

Figure A2: Inflation expectations and inflation: Czech Republic
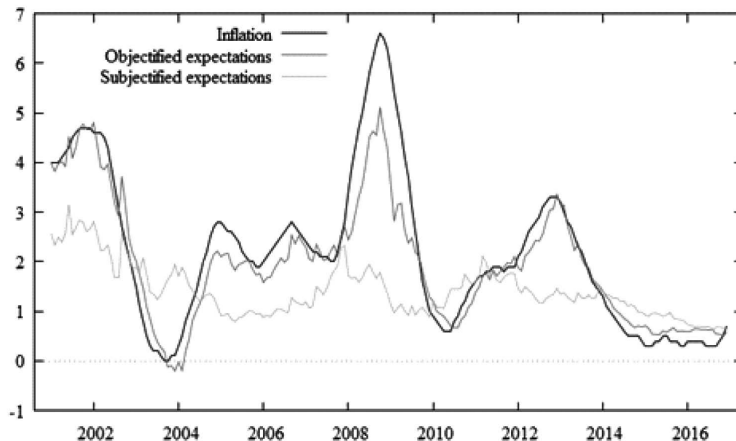
Source: Authors, based on the quantification procedure of Business and Consumer Surveys questions on perceived and expected inflation results

Figure A3: Inflation expectations and inflation: Poland
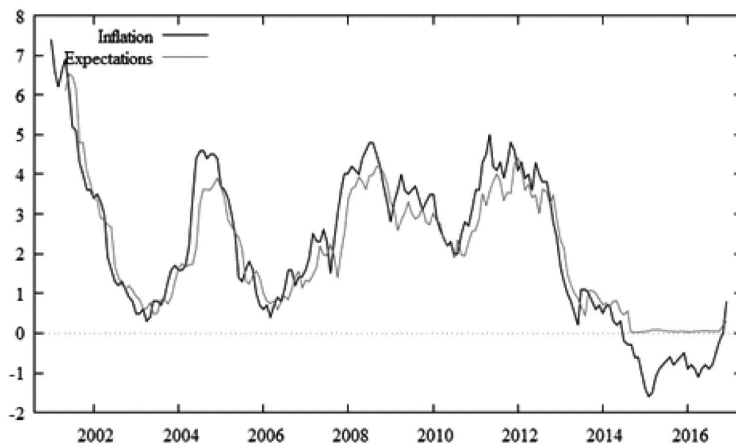
Note: Only the objectified version of quantification was applied due to the data accessibility.

Source: Authors, based on the quantification procedure of Business and Consumer Surveys questions on perceived and expected inflation results

Figure A4: Inflation expectations and inflation: Hungary
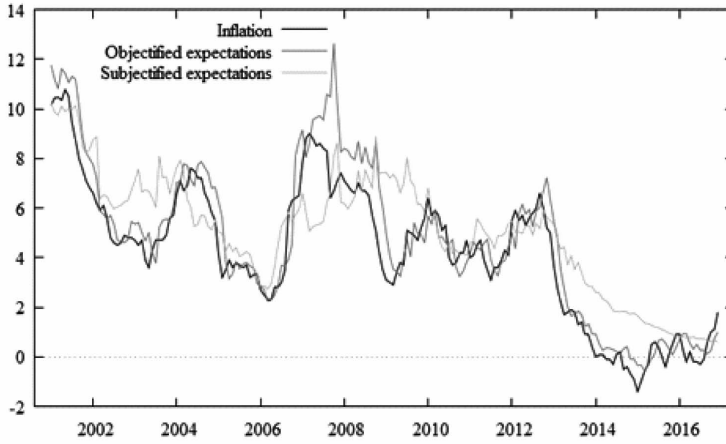
Source: Authors, based on the quantification procedure of Business and Consumer Surveys questions on perceived and expected inflation results

Figure A5: Inflation expectations and inflation: Romania

Source: Authors, based on the quantification procedure of Business and Consumer Surveys questions on perceived and expected inflation results

Figure A6: Inflation expectations and inflation: Sweden

Source: Authors, based on the quantification procedure of Business and Consumer Surveys questions on perceived and expected inflation results

Figure A7: Inflation expectations and inflation: The UK
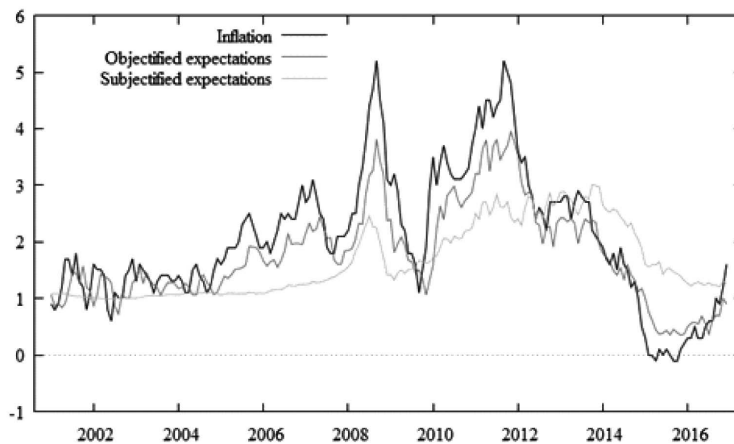
Source: Authors, based on the quantification procedure of Business and Consumer Surveys questions on perceived and expected inflation results
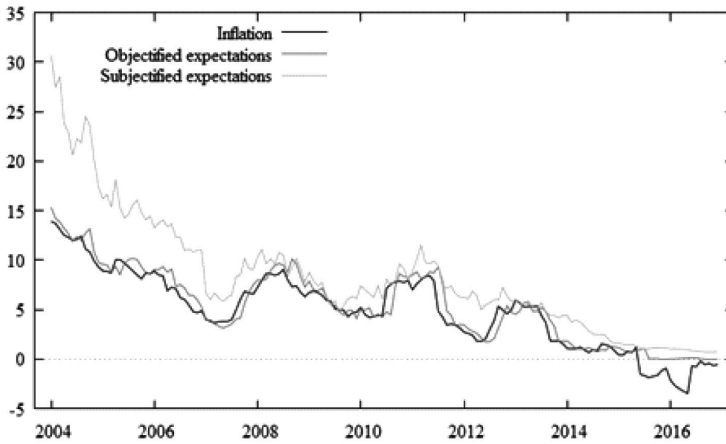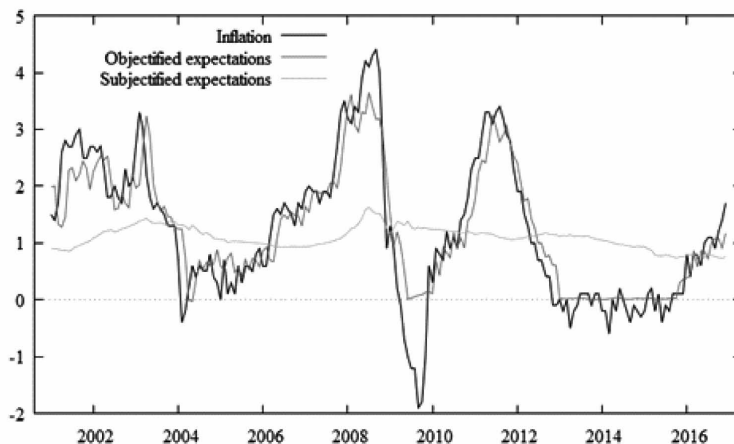
3. The rationality tests' results

Table A1: Unbiasedness of inflation expectations – results of Eq. (1)

Country		α	β	F-prob	R^2
Cz	coefficients	*2.10*	*-1.03*	251.20	0.00
	st.dev	0.17	0.06		
	p-value	0.00	0.00	0.00	
PL	coefficients	*1.74*	*-0.77*	171.20	0.49
	st.dev	0.15	0.06		
	p-value	0.00	0.00	0.00	
HU	coefficients	*2.02*	*-0.35*	13.59	0.12
	st.dev	0.33	0.09		
	p-value	0.00	0.00	0.00	
RO	coefficients	3.10	-0.36	25.98	0.15
	st.dev	0.39	0.07		
	p-value	0.00	0.00	0.00	
SE	coefficients	*1.28*	*-0.99*	264.60	0.60
	st.dev	0.10	0.06		
	p-value	0.00	0.00	0.00	
UK	coefficients	*1.14*	*-0.67*	216.50	0.55
	st.dev	0.11	0.05		
	p-value	0.00	0.00	0.00	

Source: Authors' calculations

Table A2: Estimation's results of Eq. (2) and Eq. (3)

Country	Model		*M3*	*WIBOR*	*EUR*	*IPI*	*Unemp*	*Oil price*
Cz	Eq. (2)	coefficient	0.01	0.00	-0.07	0.03	-0.53	0.01
		st.dev	0.04	0.13	0.06	0.02	0.15	0.01
		p-value	0.83	0.99	0.24	0.14	0.00	0.01
	Eq. (3)	coefficient	0.01	0.08	0.00	0.00	-0.03	0.00
		st.dev	0.01	0.04	0.02	0.01	0.04	0.00
		p-value	0.22	0.03	0.81	0.88	0.53	0.02
PL	Eq. (2)	coefficient	-0.10	-0.48	1.41	0.00	-0.10	0.02
		st.dev	0.03	0.07	0.46	0.02	0.04	0.00
		p-value	0.00	0.00	0.00	0.95	0.01	0.00
	Eq. (3)	coefficient	0.01	-0.02	0.32	0.01	-0.01	0.00
		st.dev	0.01	0.02	0.12	0.01	0.01	0.00
		p-value	0.20	0.37	0.01	0.25	0.34	0.10
RO	Eq. (2)	coefficient	-0.02	-0.01	1.36	-0.03	0.59	0.00
		st.dev	0.02	0.05	0.71	0.04	0.24	0.01
		p-value	0.32	0.81	0.06	0.50	0.02	0.79
	Eq. (3)	coefficient	0.00	-0.01	0.03	0.01	-0.02	0.01
		st.dev	0.01	0.02	0.23	0.01	0.09	0.00
		p-value	0.82	0.62	0.90	0.43	0.82	0.08
HU	Eq. (2)	coefficient	0.00	-0.04	0.00	-0.01	0.17	0.01
		st.dev	0.02	0.09	0.01	0.11	0.10	0.01
		p-value	0.87	0.68	0.80	0.91	0.10	0.05
	Eq. (3)	coefficient	-0.02	0.05	0.00	-0.06	0.01	0.00
		st.dev	0.01	0.02	0.00	0.05	0.03	0.00
		p-value	0.00	0.03	0.47	0.21	0.66	0.26
SE	Eq. (2)	coefficient	0.01	0.25	-0.89	-0.01	-0.40	0.00
		st.dev	0.02	0.09	0.25	0.01	0.13	0.00
		p-value	0.55	0.01	0.00	0.34	0.00	0.77
	Eq. (3)	coefficient	0.01	0.11	-0.22	0.00	-0.12	0.00
		st.dev	0.01	0.02	0.07	0.01	0.04	0.00
		p-value	0.09	0.00	0.00	0.90	0.01	0.01
UK	Eq. (2)	coefficient	-0.07	-0.21	1.73	-0.05	0.32	0.01
		st.dev	0.03	0.04	0.92	0.02	0.06	0.00
		p-value	0.05	0.00	0.06	0.01	0.00	0.00
	Eq. (3)	coefficient	-0.01	0.00	0.09	0.01	0.01	0.00
		st.dev	0.01	0.01	0.33	0.01	0.02	0.00
		p-value	0.55	0.73	0.79	0.42	0.54	0.00

Source: Authors' calculations

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4. Hybrid specification of expectations

Table A3: Results of full estimations

	Eq. 4 O coeff.	Eq. 4 O robust std. errors	Eq. 4 O p-value	Eq. 4 S coeff.	Eq. 4 S robust std. errors	Eq. 4 S p-value	Eq. 5 O coeff.	Eq. 5 O robust std. errors	Eq. 5 O p-value	Eq. 5 S coeff.	Eq. 5 S robust std. errors	Eq. 5 S p-value
CZ												
const	0.103	0.036	0.004	-0.174	0.050	0.001	-0.223	0.069	0.001	-0.385	0.191	0.044
α_2	0.190	0.040	0.000	0.114	0.028	0.000	0.270	0.066	0.000	0.604	0.090	0.000
$1-\alpha_2$	0.810			0.886			0.730			0.396		
α_3	-0.213	0.099	0.080	-0.108	0.037	0.010						
α_4	0.489	0.096	0.000	0.030	0.035	0.394						
Hausman test	71.252		0.000	81.071		0.000	68.199		0.000	92.026		0.000
Sargan test	3.525		0.966	13.052		0.221	17.547		0.130	82.525		0.000
weak IV test (α_2)	39.546		0.000	17.4		0	34.399		0.000	34.399		0.000
adjusted R^2	0.926			0.466			0.462			0.434		
PL												
const	-0.086	0.049	0.078				-0.085	0.110	0.440			
α_2	0.143	0.061	0.019				0.317	0.094	0.001			
$1-\alpha_2$	0.857						0.683					
α_3	-0.385	0.141	0.020									
α_4	0.631	0.134	0.000									
Hausman test	326.307		0.000				223.939		0.000			
Sargan test	5.856		0.827				16.865		0.155			
weak IV test (α_2)	2.938		0.001				6.703		0.000			
adjusted R^2	0.912						0.160					
RO												
const	0.329	0.075	0.000	1.069	0.293	0.000	2.620	0.161	0.000	2.815	0.185	0.000
α_2	0.008	0.017	0.663	0.485	0.251	0.057	0.100	0.049	0.043	0.273	0.059	0.000
$1-\alpha_2$	0.992			0.515			0.900			0.727		
α_3	-1.048	0.037	0.000	0.069	0.330	0.914						
α_4	0.020	0.041	0.632	1.213	0.262	0.017						
Hausman test	6.699		0.082	9.41		0.02	2.176		0.140	6.809		0.009
Sargan test				10.61		0.39				46.142		0.000
weak IV test (α_2)				2.90		0.00				11.731		0.009
adjusted R^2	0.976			0.750			0.015			0.015		

	O			S			O			S		
	coeff.	robust std. errors	p-value	coeff.	robust std. errors	p-value	coeff.	robust std. errors	p-value	coeff.	robust std. errors	p-value
HU												
const	0.481	0.125	0.000	0.329	0.269	0.221	0.354	0.054	0.000	1.104	0.144	0.000
α_2	0.011	0.035	0.758	0.207	0.135	0.127	-0.150	0.061	0.014	0.781	0.096	0.000
$1-\alpha_2$	0.989			0.793			1.150			0.219		
α_3	-1.019	0.099	0.000	-0.533	0.075	0.000						
α_4	0.065	0.091	0.475	-0.162	0.107	0.027						
Hausman test	0.279		0.841	15.288		0.02	11.772		0.001	69.273		0.000
Sargan test	17.573		0.063	3.769		0.39	11.090		0.436	14.501		0.270
weak IV test (α_2)				5.276		0.00	7.001		0.000	8.617		0.000
adjusted R^2	0.954			0.671			0.002			-0.338		
UK												
const	-0.133	0.101	0.187	-0.251	0.048	0.000	-0.323	0.094	0.001	-0.453	0.257	0.078
α_2	0.408	0.236	0.084	0.238	0.112	0.044	0.505	0.105	0.000	1.175	0.261	0.000
$1-\alpha_2$	0.592			0.762			0.495			-0.175		
α_3	1.564	0.234	0.000	-0.379	0.062	0.000						
α_4	0.785	0.222	0.037	-0.198	0.063	0.028						
Hausman test	107.281		0.000	6.419		0.000	240.588		0.000	304.064		0.000
Sargan test	7.472		0.279	10.999		0.358	13.316		0.346	12.313		0.421
weak IV test (α_2)	1.877		0.059	3.334		0.000	4.981		0.000	4.981		0.000
adjusted R^2	0.243			0.683			0.151			0.039		
SE												
const	0.118	0.110	0.285	-0.001	0.005	0.923	0.065	0.050	0.195	-0.090	0.061	0.141
α_2	0.367	0.138	0.009	0.019	0.018	0.290	0.226	0.046	0.000	0.468	0.030	0.000
$1-\alpha_2$	0.633			0.981			0.770			0.532		
α_3	-1.660	0.231	0.000	0.031	0.018	0.090						
α_4	-0.425	0.201	0.184	0.026	0.017	0.126						
Hausman test	73.091		0.000	26.626		0.000	73.244		0.000	11.116		0.001
Sargan test	0.858		0.354	0.294		0.587	7.859		0.050	161.913		0.000
weak IV test (α_2)							43.410		0.000	206.597		0.000
adjusted R^2	0.909			0.006			0.443			0.566		

Note: The grey models are not interpreted, because they failed one of the diagnostic tests or have too week determination coefficients.

Source: Authors' calculations

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5. Robustness check of the results of estimations

Table A4: Comparison of estimators

Country	Expecta-tions	2SLS		GMM		Z-test	p-value
			sd		sd		
CZ	O	0.190	0.060	0.160	0.083	0.292	0.385
	S	0.110	0.028	0.142	0.024	-0.866	0.193
PL	O	0.140	0.072	0.177	0.069	-0.372	0.355
RO	O	-0.065	0.043	-0.113	0.053	0.710	0.239
	S	0.889	0.639	0.555	0.358	0.457	0.324
HU	O	-0.004	0.966	0.062	0.190	-0.067	0.473
	S	0.207	0.127	0.708	0.431	-1.115	0.132
SE	O	0.367	0.138	0.289	0.086	0.480	0.684
	S	--	--	--	--	--	--
UK	O	0.550	0.105	0.514	0.241	0.137	0.446
	S	0.240	0.043	0.136	0.068	1.293	0.098

Note: We tested significance of differences of forward-lookingness coefficients between the models estimated with 2SLS and GMM methods with Z-test (Paternoster et. al. 1998).

The null hypothesis is that the difference between two coefficients is equal to zero.
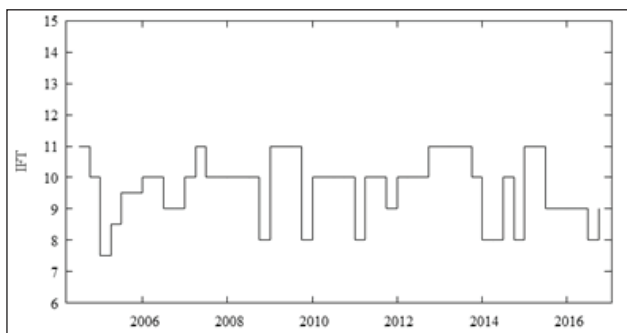
Source: Authors' calculations

6. Inflation forecasts targetingtassessment

Figure A8: IFT index evolution: the Czech Republic
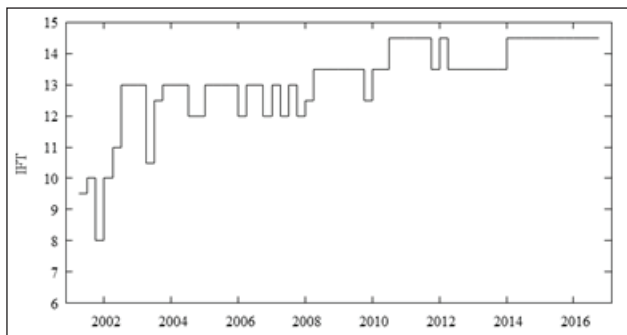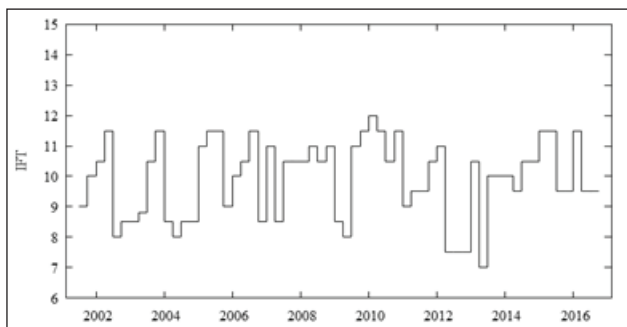

Source: Authors

Figure A9: IFT index evolution: Poland

Note: presented since the first publication of the central bank forecast
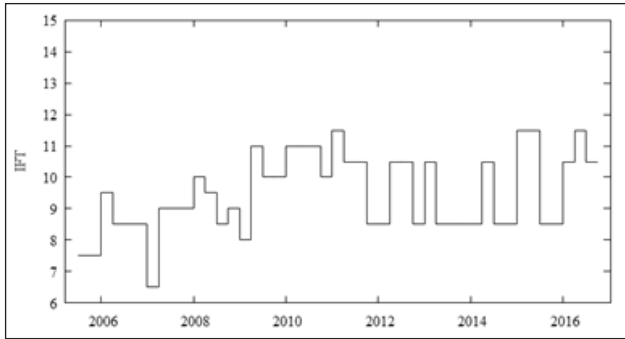Source: Authors

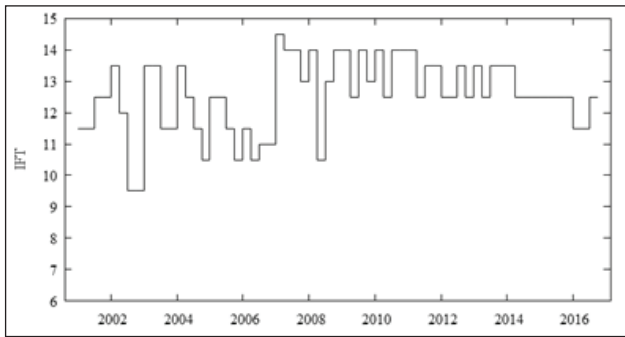Figure A10: IFT index evolution: Hungary

Source: Authors

Figure A11: IFT index evolution: Romania

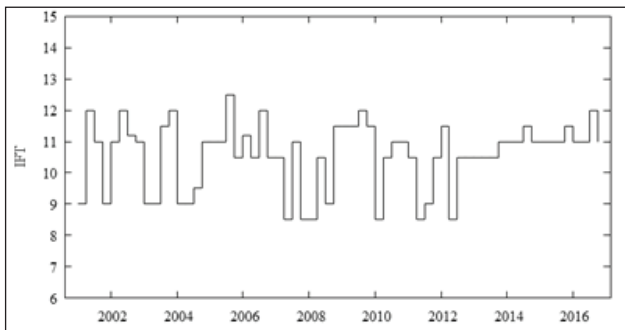Note: presented since the first publication of the central bank forecast
Source: Authors

Figure A12: IFT index evolution: Sweden

Source: Authors

Figure A13: IFT index evolution: the UK

Source: Authors