WORKING PAPER

14 (53) 2013

BANK OF ALBANIA

INFLATION FORECASTING PERFORMANCE AND MONETARY POLICY DECISION-MAKING DURING 2011-2012

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The authors are grateful to Mr. E. Themeli and Mrs. H. Shijaku, for their valuable suggestions and support for this paper. They also thank the colleagues of the Monetary Policy Department for providing additional information in order to better fulfil the goal of this paper, as well as the colleagues of the Monetary Policy Department and Research Department at the Bank of Albania, for participating in the discussion of this material.

CONTENTS

1. Theoretical and practical considerations on the inflation forecasting 7

2. Short overview of the inflationary process during 2011-2012 13

3. Performance Analysis of the inflation forecasts: 2006-2012 18

4. Comparative overview: 2006-2010 versus 2006-2012 36

5. Conclusions and recommendations 43

Literature 47

Appendix 51

ABSTRACT

The paper analyses the performance of the inflation forecasting and its role in the monetary policy decision-making at the Bank of Albania over 2011-2012. The study identifies the main challenges facing the projection process, focusing on published inflation versus the forecasts and expectations values and the monetary policy formulation as well. The accuracy of inflation forecasting models in use is studied through a set of statistical indicators and econometric tests. The results for the entire period 2006-2012 are compared to those of the period 2006-2010. The paper concludes that the combination of all forecasts as simple average has consolidated its position as the most accurate forecast at a 6-quarter horizon, whereas in the 4-quarter one the mean of deviations reaches almost the zero value. The extension of time series with the data of the period 2011-2012, has enabled more convincing testing procedures on optimality and efficiency of the inflation forecast. Optimality is extended at a 6-quarter horizon, while the estimates for efficiency, although improved, appear not entirely sustained beyond the short-term horizon. The inflation forecast framework over the period 2011-2012, demonstrates that some of the risk scenarios are situated as baseline ones in the following projection rounds. This risk scenarios behaviour has raised the attention of the monetary policy decision-makers regarding the increased probability in risks materializing for the future performance of the key macroeconomic indicators.

Keywords: inflation forecasting, forecast performance, properties of forecasts, monetary policy.

JEL Classification: E31, E37, C52, C53, E52.

ABBREVIATIONS

1.	Total	Headline inflation model
2.	Core_Ncore	Core Non-core inflation model
3.	4_Categories	4 Categories inflation model
4.	TR_N_NTR	Traded Net Non-traded inflation model
5.	Average	The simple average of models' results (1) - (4)
6.	Actual	Actual published inflation value
7.	FE	Forecast error measured as difference = Actual – Forecast
8.	ME	Mean of forecast Error
9.	RMSE	Root Mean Squared Error
10.	RRMSE	Relative Root Mean Squared Error
11.	FD	Forecast Direction (Correct)
12.	RFD	Relative Forecast Direction (Correct)
13.	Q	Quarter
14.	h	Horizon

1. THEORETICAL AND PRACTICAL CONSIDERATIONS ON THE INFLATION FORECASTING

1.1 INFLATION FORECASTING: A THOROUGH PROCESS

The primary objective of the monetary policy is the maintenance of consumer price stability in the economy. In the monetary policy document (Bank of Albania, 2012), this objective is specified as maintaining the annual inflation at 3.0% in the medium term, with the possibility of short-term fluctuations, of ±1 percentage point around the central value[1]. Maintaining price stability over time close to the inflation target is realized through the forward looking monetary policy decision-making process. This is because the transmission of its decisions requires a necessary time to affect the inflation rates and the real sector of the economy. In order to precede the future inflationary developments, the monetary policy should be heavily supported by the economic forecasts. Macroeconomic developments in the last five years have become more complex, charged with uncertainties and increased regional and global risks; therefore, the forecasting of inflation and its determinants is significantly hampered. Meanwhile, representing the main instrument of the monetary policy, the key interest rate is one of the determinant variables for future inflation developments. Theoretically, its performance is defined by a loss function or from a simple monetary policy rule, which at the same time shows the central bank's commitment to achieving its primary goal. Some central banks publish not only the forecasts for the variable that expresses the primary objective, but also a set of projections for other variables, not fully under its control or target.

A material of the Swedish central bank (Riksbank) regarding the projection of one of the main indicators quotes: "... This repo-

[1] Regarding the legal aspect see "Monetary policy document for the period 2012-2014", Bank of Albania, p. 5. The same document addresses the quantitative objective forms: http://www.bankofalbania.org/web/Monetary_Policy_Document_for_2012_2014_6346_2.php

rate path is a forecast, not a promise... "[2]. Forecasting is a process associated by confidence and error probabilities, which, in turn, must be explained in detail to the public, particularly when projections are regularly published. Meanwhile, the "promise" is an act based on the institution's credibility. For this reason, the forecasting process is accompanied by a clear communication of monetary policy decisions to the public, based on an optimal transparency (Jensen, 2001). Optimality is significantly determined by the benefit/cost ratio of monetary policy transparency. This ratio depends especially on the time of projections (Bulíř et. al., 2012). If forecasts for future periods are based on assumptions with a high likelihood of occurrence, a higher transparency in the communication of monetary policy to the public would support and guide the alignment of the latter's expectations towards the Bank's primary objective. In turn, this would further enhance institutional credibility. Otherwise, when the baseline assumptions are surrounded by high uncertainties, the projections would be much more vulnerable over the forecasting horizon. In this case, the transparency on the communication of monetary policy decisions should not compromise the credibility of the Bank and furthermore, increase the volatility of public inflation expectations. Therefore, the whole projection process, particularly the inflation one, should be accompanied by a complete explanation of the nature of the: expected shocks; their intensity; the degree of dispersion; and their persistency over time.

Forecasting is a complex process, conditioned by factors inside and outside of modelling. Because it is particularly hard to predict accurately in periods of high economic uncertainty, the support of the monetary policy decision on the projections is focused not only on quantitative inflation projections, but also on the risk probability distribution surrounding the central forecast. In particular, the projections are considered for their signalling power regarding a qualitative assessment of the future inflationary pressures: declining, increasing or remaining unchanged over the monetary policy reaction horizon. Focusing on consumer price stability, monetary policy decision of the Bank of Albania is oriented toward

[2] Sveriges Riksbank, "Materials for Assessing monetary policy", 2011, in the introductory section "Monetary Policy in Sweden".

the expected consumer price developments in the medium term, which are generally determined by demand side factors. Short-term shocks to consumer prices, which are mainly caused by supply factors, are assessed for the possibility to transform into second-round effects. In this process, the inflation projections, resulting from a diversified portfolio of models, have been a strong starting point in structuring a more comprehensive discussion regarding the expected inflationary pressures situation in the economy[3]. Models are based on economic theory, empirical studies and behaviour analyses of certain indicators in the economy. But models are simplified mathematical representations of the economic reality and their results cannot be absolute. Because of this, the models in the forecasting practice are updated and re-evaluated in time. Also, new regressions and conclusions of analysis and economists' judgments from different sectors are incorporated in this process. Consequently, the projection results are more comprehensive, aiming higher forecasts' accuracy. In this context, the role of economists' judgments is essential, because they have a more thorough understanding of the situation and variables not included in the models. Rosenberg (2008)[4] considers the advantages of the judgment quantifications in order to fulfil the assumptions framework, particularly when uncertainties are high. She notes that, when unexpected and unusual events or structural changes occur, affecting inflation or its determinants series, the results of models must be corrected by assessments of economic experts.

During 2011-2012, the inflationary process in Albania faced some "surprises". In this respect, the economists' judgments on designing assumptions were beneficial, besides running different models for forecasting inflation and its main determinants. The combination of experts' judgments and models results has been helpful for the policymakers to understand more coherently this process. In the introductory part of this study, we summarized the main challenges facing inflation forecasting. In the second section, we present an economic analysis of facts and trends determining

[3] Çeliku & Hashorva, 2012, Bank of Albania, Working Paper, Nr. 01 (51) 2012, pages 12-13.

[4] Irma Rosenberg, Sveriges Riksbank, Stockholm, 13 June 2008: "The monetary policy decision-making process", in the section "The forecasts are result of an interplay between models and assessments".

inflation during 2011-2012, as well as the monetary policy decision-making in recent years in Albania. The purpose of this section consists in confronting the results of this analysis with the challenges of forecasting introduced in the first section. In the third and fourth sections, we present the main results of performance indicators and the properties of the average inflation forecast in a comparative perspective among: models; horizons; and periods of inflation forecasting. In the following, we analyse the deviations by decomposing them according the main causes. For the first time a study of this field sheds light on the risk scenarios designed for the monetary policy decision-making purposes, beside the probabilities of uncertainties surrounding the baseline projections. In order to increase the forecasting accuracy, the fifth section presents the conclusions and recommendations for further improvements.

1.2 INFLATION FORECASTING: A CHALLENGING PROCESS

The monetary policy decision making relies on the forecasts of inflation and its main determinants and on other economic projections. Because of this, it is important to achieve a high accuracy of the projections. An appropriate step in this assessment consists of the comparison between published inflation and the inflation forecasting results conducted previously for the period under review. In Bank of Albania's case, the comparison is realized with forecasts' results carried out 1-8 quarters ago. In this context, the analysis, evaluations and economic projections for the period 2009-2010 have supported the BoA's Supervisory Council in decision-making regarding the policy interest rate level. This process has impacted the inflationary pressures and the real sector of the economy over the following years (2011-2012). Meanwhile, the decisions taken during 2011-2012 have impacted on the inflation and the formation of the inflation expectations in the medium term, formulating a gradually easing monetary conditions in the economy.

What kind of challenges faces the central banks on the forecasting inflation process?

The answer to this question links to the fact that economic models are not and cannot be deterministic. They make room for different applications of statistical inferences regarding various probability distributions–properties that imply deviations from modelling itself. This is an unavoidable challenge. Errors at this stage can be minimized only through improvements of models specification. But the forecasting process is accompanied by other additional uncertainties. The economy and inflation are continuously affected by unexpected shocks. This makes the forecasts accuracy vulnerable, in many cases significantly vulnerable. Performing a forecasting accuracy analysis for a short time period (1-2 years), when these shocks may happen or not, would limit the information regarding the performance of the forecasting process. High forecast errors may indicate that forecasts themselves have been not good. But, if it is verified that the main source of errors is generated from shocks which were not supposed to happen at the forecasting moment, the problem is not in the models, but it is related to the shocks information and size of materialization on the forecasts. This is another challenge, which will be solved, if the sources of the deviations of the forecasts performed in the previous quarters are clearly explained.

The possession of a long forecasting history is another challenge that sheds light on the forecasting accuracy. Forecasts must not overestimate or underestimate inflation over a sufficiently long period. If one of the above situations is verified in average terms for long time series, it would be considered as sufficient information for revisiting the forecasting models, reformulating more accurate assumptions or even both simultaneously.

Forecast accuracy must take into account the degree of information possessed at different forecast horizon points. Then, this is another challenge in the upcoming prediction: the longer the forecasting horizon the lower the amount of future information regarding inflation determinant variables, and vice versa: forecasters may use more reliable information for inflation forecasting as the date of inflation publication approaches. But the main principle of monetary policy decision making consists is to forward looking in order to mitigate the future inflationary pressures. Hence, its interest

for short term inflation forecasts is moderate. However, the world economic processes nowadays demonstrate that the movements of long-term equilibriums occurred because within the short and medium-term horizons irreversible shifts are verified. For this reason, it is necessary to evaluate the forecasts' results in each step of the forecasting process and for all horizons, in order to increase the efficiency of the monetary policy decision making.

Given the above challenges of the inflation forecasting, the performance analysis of models as a procedure previously applied in the case of Albania[5], consists of: comparison of forecasting performance among models including the approach of averaging results of the models in use; comparison of the forecasting performance of each model with the results of the reference model (Benchmark - ARIMA); comparison among forecasts according to different horizons; analysis of the direction accuracy of the forecasts; analysis of statistical properties of forecasts.

To address the above challenges, the analyses are extended over the maximum period of the forecasting history at the Bank of Albania, 2006-2012. Comparing performance results with those of the period 2006-2010[6], we may conclude whether there is an improvement, deterioration or no changes of the predictive accuracy. Additional period 2011-2012, besides increasing the number of observations, will be "responsible", "positively, negatively, or neutrally" for inflation forecasting accuracy performance.

[5] Hashorva et al. (2006); Çeliku and Hashorva (2012).

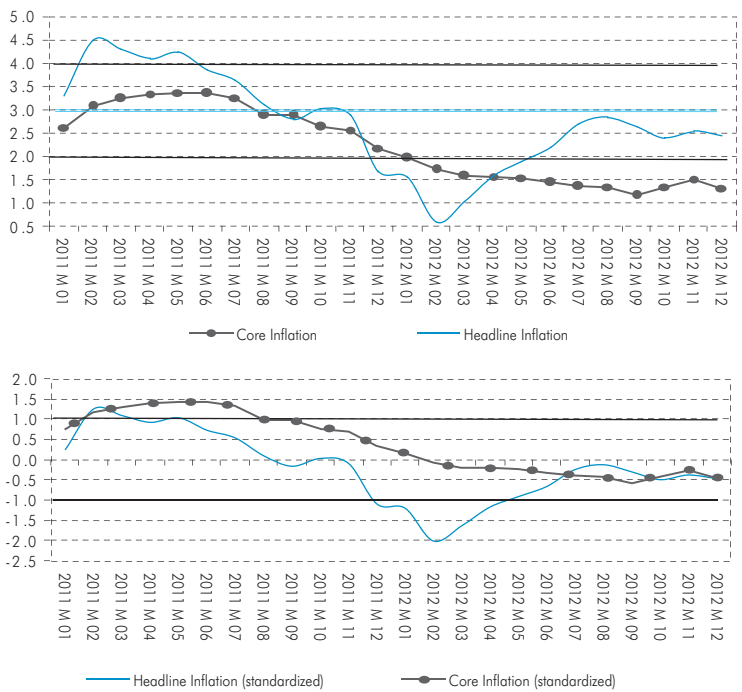
[6] Çeliku and Hashorva (2012).

2. SHORT OVERVIEW OF THE INFLATIONARY PROCESS DURING 2011-2012

2.1 STYLIZED FACTS: THE INFLATIONARY TREND VIS À VIS THE SHOCKS

Over more than one decade, the average annual inflation rates have fluctuated around 3% with 1.2 percentage points of standard deviation. Based on statistical properties of the annual inflation time series[7], it is concluded that the annual inflation during the period 2011-2012 generally fluctuated in a range of ± 1 standard deviation, except for two situations: M2:2011-M5:2011 and M12:2011 - M4:2012.

Chart 1: Annual Inflation Rates Measurements: 2011-2012.



Source: INSTAT, Bank of Albania and authors' calculations.

[7] When some particular values (outliers) pertaining to shock periods are excluded (for example: confidence crisis of spring 2002), the annual inflation series follows a normal distribution (based on Jarque-Bera, Kolmogorov, etc., tests results).

The first period reflected the shocks generated from the increases in the oil and food prices in foreign markets. According to economic analysis (ECB, 2012)[8], it was a supply-side shock. The supply of above-mentioned commodities was reduced in certain regions due to geopolitical developments and bad weather conditions (regional conflicts, droughts, floods and fires). In specific regions of major petroleum and cereals producers, production decreased temporarily. Prices of some agro-industrial products rose, but not from the demand side factors as in 2007-2008. As such, it was amortized even faster than the projections of the international institutions (FAO, IMF and EcoFin). Consequently, their earlier forecasts have been significantly revised in downward, while the volatility of inflation expectations in domestic and external economic environment has been smoothed in line with the slowdown of price increases for primary commodities. Due to the foreign developments and the considerable dependence on imports, the headline inflation in the Albanian economy after June 2011, slowed down markedly. The annual core inflation fell more slowly, due to its higher persistency. It fluctuated within the range of ± 1 standard deviation after August 2011, when the effect of higher cereal prices was completely extinguished (Chart 1, below).

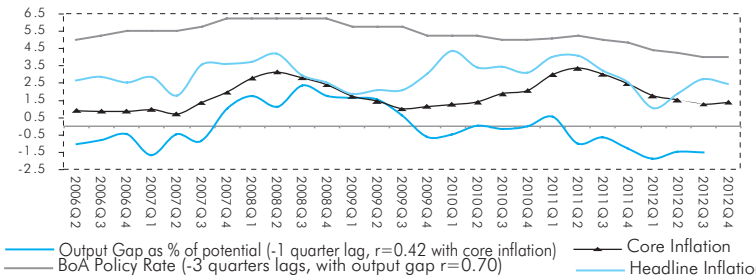
The second shock in a significant downward direction was prompted by the "surprise" in the prices' developments of the domestic unprocessed foods. The deviation from seasonal behaviour, in the presence of: administrative measures; growth of agricultural products exports; and the statistical base effect, were the main causes of the low inflation rates, especially during the first months of 2012. During the second half of 2012, the inflation began to fluctuate within the range of the lower tolerance band, due to the extinguishing of the aforementioned statistical effect. Whereas headline inflation resulted significantly below the (-1) standard deviation line, the core one, despite its downward trend, didn't cross this line, underlining the transitory nature of the shock and more isolate than that of 2011. The stable performance of the exchange rate contributed to supporting these developments.

[8] ECB, Monthly Bulletin, September 2012, p. 63.

2.2 THE MONETARY POLICY REACTION: INFLATION IN A MACROECONOMIC FRAMEWORK

Negative output gap in the medium term (Chart 2), conditioned by the partial and low rates of capacity utilisation in the economy, weak conditions in the labour market and productivity as well, weakened the inflationary pressures in macroeconomics environment from the aggregate demand side: the latter one was almost stagnant. The particularly low profile of annual core inflation rates in 2012 (1.5%), reflects the domestic demand weakening.

Chart 2: Inflation rates and output gap measurements* and BoA policy rates (2006-2012).



Source: INSTAT, Bank of Albania and authors' calculations

*The output gap is a macroeconomic indicator, which is measured as: (current output - potential output)/output potential. The potential output is estimated using statistical filtering methods. More details are given in: Bank of Albania, "Monetary Policy Report" 2011 Q1; Box 2. Empirical estimates show that the output gap is positively correlated with certain time lags with inflation, especially with the core one and the BoA's policy rates series. The linear correlation coefficients result 0.4 and 0.7, respectively.

The overall macroeconomic environment was supported by easing monetary policy, over September 2011 - December 2012. Meanwhile, in the previous months of 2011, as a result of higher and fluctuated inflationary expectations of market agents, the BoA policy rate was increased from 5% (it had been unchanged for 8 consecutive months) to 5.25% in March 2011. Despite the supply side nature of this shock, the monetary policy decision making assessed that risks for possible materialisation of this shock effects into second-round ones were not negligible. In the subsequent periods, these effects appeared, but they were partially materialized in the chain: consumer prices-inflation expectations - wages. On the one hand, the weakening of the demand was reflected to the stabilization of the inflation expectations and low pressures from labour and production costs. On the other hand,

the projections signalled a trajectory for inflation below the 3% level and the continuing of negative output gap, encouraging the pursuit of the easing monetary policy decision making nature. In the time frame of 16 months (September 2011 - December 2012), the BoA cut the key interest rate five times by 0.25 percentage points to 4%. According to assessments, the headline inflation in 2012 would have resulted even lower than the average rate of 2%, without the stimulating monetary policy stance. Inflation forecasts, in turn, include as new information the updated policy rates bearing the effect of its movements, firstly in core and non-tradable inflation components and secondly in the headline one. In general, assumptions over the inflation forecast horizon were conditioned by keeping the key interest rate unchanged, after successive cuts.

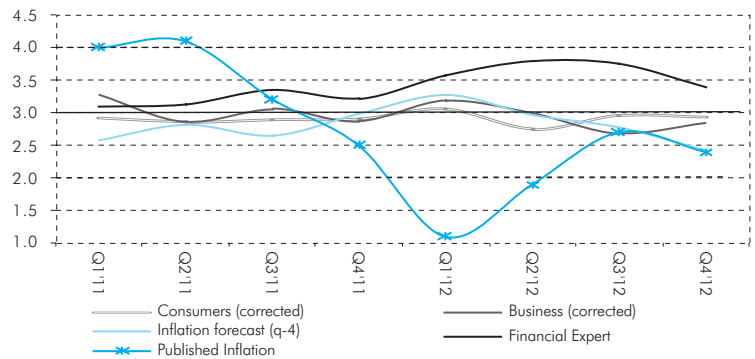
2.3 INFLATION: EXPECTATIONS VERSUS FORECASTS

Developments in consumer prices, as well as the current and expected performance of the main indicators of real, fiscal, financial and external sectors of the economy have supplied assumptions for inflation forecasts over sufficiently long-time horizons and have helped form inflation expectations. They are assessed as relatively anchored within the interval of 2%-4%. During 2011-2012, the inflation expectations of businesses, consumers and financial market agents, have not transmitted convincing signals for the emergence of any inflationary spiral over the inflation forecast horizons, although there have been some temporary fluctuations. More vulnerable horizons to the fluctuations' expectations extend to four quarters, because the expectations of the interviewed groups are more influenced by the current and perceived consumer prices performance and prices of commodities in the international markets[9]. Beyond this horizon, the expectations are more stable over the medium-term target, indicating a considerable degree of credibility to the inflation target and consequently to the Bank's monetary policy making.

[9] This nature of expectations and forecasts over the closer time horizons consists even in developed economies, where expectations play an important role, and the transparency of monetary policy and the projections have a very open profile (Sveriges Riksbank, Materials for Assessing monetary policy, 2011, p. 46).

But, how the inflationary expectations have moved versus inflation forecasts over the 4-quarter horizon during 2011-2012? The results indicate that the main actors of the domestic market have failed to capture the shocks addressed in the introductory paragraph of this section. Especially in the second period, the shock indicates a considerable deviation from the forecasts and expectations, highlighting its particularly unexpected nature (Chart 3). The inflation expectations of financial agents result the highest ones and more positively deviated from the forecasts. For the period 2011-2012, the inflation expectations of businesses and consumers and the forecasts have fluctuated within the interval of 2.5%-3.2%.

Chart 3: Forecast and corrected inflationary expectations vs. published inflation, 2011-2012.



Source: INSTAT, Bank of Albania and authors' calculations.

Inflation expectations and forecasts are positively correlated, for the maximum lengths of the respective time series. For financial experts and consumers' groups, the linear correlation coefficients have proved an average correlation, of 0.5 and 0.6 respectively, suggesting their involvement in inflation forecasting models in the near future[10].

[10] Technically, it is difficult to be included due to the short time series.

3. PERFORMANCE ANALYSIS OF THE INFLATION FORECASTS: 2006-2012

3.1 FORECASTS ACCORDING TO MONTHLY AND QUARTERLY MODELS

Results generated from monthly and quarterly inflation forecasting models have continued to support the monetary policy decision-making over 2011-2012. Monthly models use information on a monthly basis, when it is available in this frequency. The quarterly data series are interpolated to monthly ones. Due to the higher frequency, monthly models produce more results but their added value consists of updating inflation forecasts within quarters, using the monthly results. Within a quarter, two monthly updates can be realized. If the monthly updated results lead to significant changes compared to the quarterly forecasts, previously presented, the reasons behind the changes need to be argued. They may be related to changes in initial conditions for inflation and its determinants. There are cases when new information during the current month dictates the revision of the assumptions designed in previous projections. In general, during the period 2011-2012, monthly forecasts have not brought substantial changes from quarterly ones. Mostly, they transmitted the new monthly information from inflation and its categories. Meanwhile, monthly inflation forecasts have resulted close to the published values at least over a 12-month time horizon.

Considering the above considerations and the issues handled in Çeliku and Hashorva (2012), the analysis of the performance models is focused on the quarterly forecasts. The following step presents the results of the performance analysis according to different models and horizons. Results of the average approach for quarterly model forecasts are applied for constructing the Fan-Chart, at a 4-quarter horizon. Since the fourth quarter of 2011, the inflation forecast interval corresponding to the 90% probability, is published in the press releases of the monetary policy decision-making and in the governor's foreword in the Bank of Albania's Quarterly Monetary Policy Reports. Based on the advanced

practices of medium-term forecasting (Berg, et.al., 2006), the results of the quarterly forecasting models are periodically included as raw material in the semi-structural model[11], especially during 2012.

3.2 FORECASTING PERFORMANCE INDICATORS: RESULTS AND ANALYSIS

Graphical presentations, results of specific statistical indicators and econometric tests for the forecast errors series are tools widely used[12] to shed light on the forecasting performance according to models. The forecast errors time series will be analysed as previously (Çeliku and Hashorva, 2012)[13] according to three comparative dimensions: (i) among results of the inflation forecasting models, (ii) models' results versus the reference model (Benchmark) ones (iii) the model results according to different forecast horizons. Analysis in terms of forecasting performance indicators are focused on a range of time horizons, of 1-6 quarters ahead, aiming to include the monetary policy reaction horizon[14].

The forecasting performance analysis combines the ex-ante approach with the ex-post one. The deviation series between the published inflation in the quarter "Q" and the forecasts results conducted previously (in different time horizons) based on models and assumptions for the main previously-designed inflation determinants, are calculated based on the ex-ante approach. Meanwhile, the analysis of the sources of the deviation between published inflation with forecasted one are conducted based on ex-post approach[15].

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[11] The projections and simulations through the Gap model are achieved by including the results of quarterly short-term forecasts for inflation, real GDP, exchange rate, quantifying experts' judgments, etc.

[12] Andersson, M.K. et. al., (2007); Andersson, M.K., (2000); Andersson, M. K. & M. Lof (2007); Stock, J. & M. Watson (2002, 2006); Mukherjee, D. and D. Kemme; Sveriges Riksbank (2008); (2009, 2010, 2011); Reserve Bank of New Zealand.

[13] Measured as the difference between the published inflation and the forecasted one in different time horizons (h = 1, ..., 8).

[14] "Monetary Policy Document 2012-2014", Bank of Albania, 2012.

[15] This analysis is presented in the 4th section of the paper.

Based on the forecast errors series, there are some basic properties that must be checked for measuring the forecasting performance of the models and hence more accurately model or combination approach.

Box 1: Utilisation and interpretation of performance indicators*

a) *Forecasting accuracy in terms of average size of errors is measured through the main statistical indicators: Mean Errors (ME); Mean Absolute Errors (MAE); Root Mean Square Errors (RMSE); Normalized Root Mean Square Errors (NRMSE); Coefficient of Variation of Root Mean Square Errors (CVRMSE)*[16].
b) *The smaller the value of each of the indicators, the more accurate is the forecast and more reliable the model is; Usually RMSE indicator for each model/combination of some or all results is compared to that resulting from a benchmark model (generally an ARMA/ARIMA structure of the model). The value resulted from this comparison is called Relative RMSE (RRMSE). The value of ratio must be less than 1, indicating that the models perform with smaller errors than an ARIMA one. If the opposite happens, the benchmark model will be recommended to be used in inflation forecasting;*
c) *In order to assess whether the forecasts tend or not to predict consistently the correct direction of the future annual inflation fluctuations (increase/decrease/unchanged, compared to the previous quarter/year), the indicator of correct direction of the forecast (DF) is used;*
d) *Through tests suggested by Nordhaus (1987), Mincer and Zarnowitz (1969) and Andersson MK et. al. (2007), a re-evaluation of the efficiency and optimality properties for longer time forecast horizons than in the study covering the period 2006-2010, has been made.*

*For more details regarding the indicators, see Çeliku and Hashorva (2012), pg. 25-27; 33-34.

[16] Here, it is also included the combination of the forecasts' results from all models in use, in average terms.

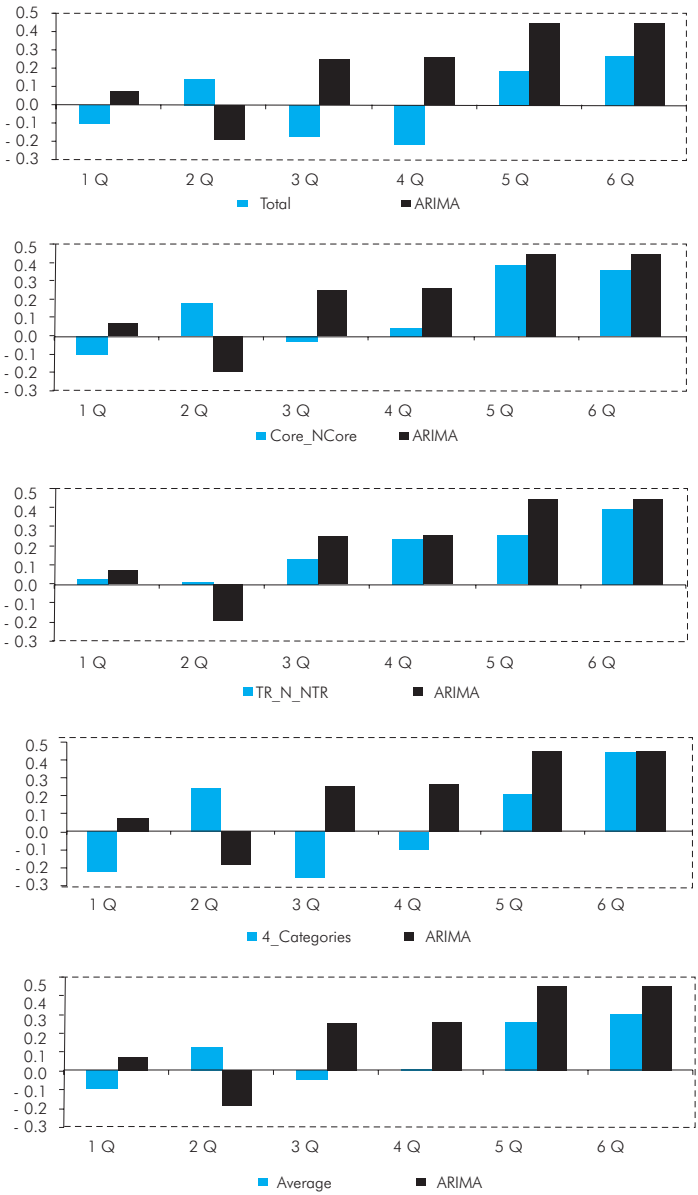
Noting that the statistical inference and indicators, as well as other econometrical tests applied on the whole forecasting performance evaluation process, are very sensitive to the sample size (MK Andersson et. al., 2007), the performance analysis will be implemented for the maximum length of inflation forecasts time series versus the published one over the period 2006-2012. For a given period, the length of the forecasts' errors time series falls, if the forecast horizon is extended. Reducing the sample size might cause partial or complete increase of average forecast error. The main results of the performance analysis for the entire period will be compared to those of the period 2006-2010, in order to conclude how well the predictions of the last two years (2011-2012) have influenced the accuracy of the inflation forecasts. How this performance is impacted by shocks already treated? Have these shocks caused such changes in the inflation behaviour that the existing models failed to capture?

Results for all statistical indicators of the inflation forecasting performance are in Appendix 1 of this study. In the following, the results of ME, RMSE and FD are graphically presented, according to models and at the 1-6 quarter horizon. Among all indicators, the afore-mentioned were selected because of their direct messages. They are also extensively used in the literature and in practice of this kind of evaluation. The ME informs about the systematic or random nature of the error terms over time, throwing light on the quality of the models. RMSE is focused on the predictive accuracy. The values of these indicators together with those of FD are compared to the respective results of a benchmark model (ARIMA) (Figures 4, 5 and 6). Appendix 1 presents the result of relative indicators (compared with ARIMA), RRMSE. A value less than 1 indicates a higher accuracy of the models against a "naive" one. A RFD greater than 1 indicates that the forecasts of models in use have the ability to capture better than a "naive" model, the correct direction of the inflation forecasts over the different time horizons and vice-versa.

- Over the horizon of 1-4 quarters, the ME fluctuates in a low interval of values: -0.26 to +0.23 p.p. centralised very close to zero. In these horizons, the forecasts fluctuate slightly above or below the published inflation.

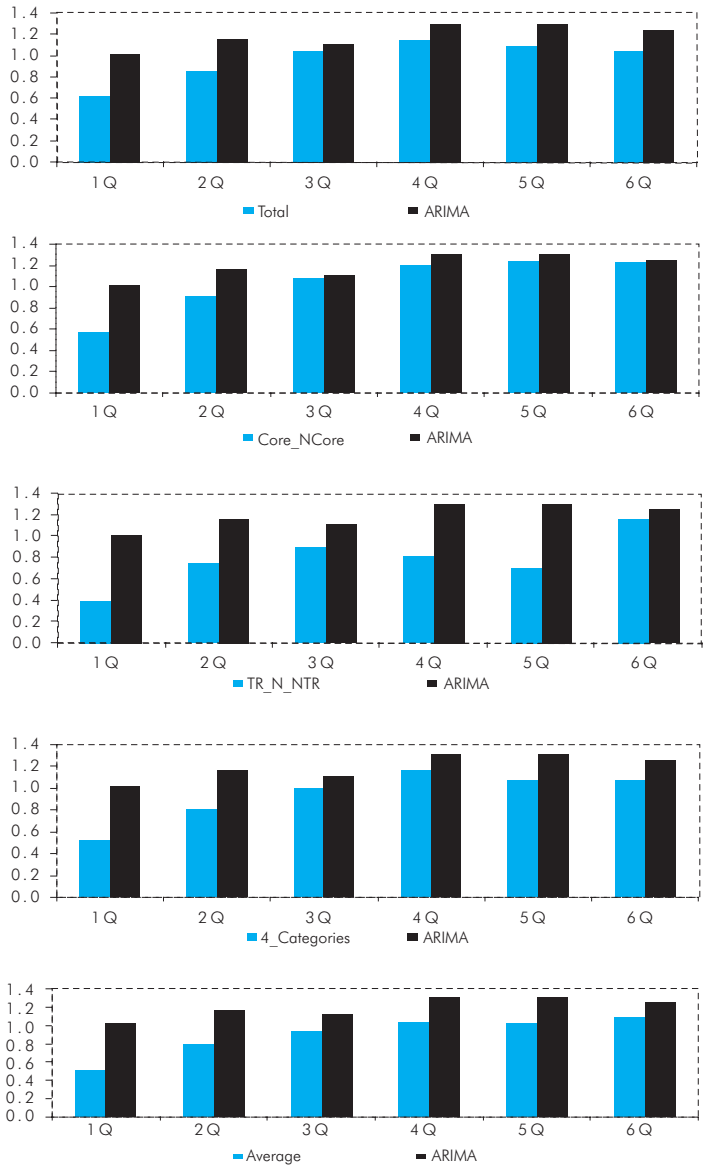
- Beyond four quarters, the ME has mostly the positive sign, indicating lower forecast values than the published ones. Specifically, for horizons of 5 and 6 quarters, the size of ME for all models, excluding the four categories, does not exceed 0.4 pp.
- The average approach of models' results has the lowest values of ME and RMSE on the horizon of 1-6 quarters compared to each model in use.
- The ME value is almost zero at the 4-quarter horizons.
- Among the models, the higher forecast accuracy is represented by the core/non-core and two- sectorial (TR / N_NTR) ones; the sectorial model has the smallest RMSE value over short-term horizons;
- MEs and RMSEs of all models result lower than those of the ARIMA model for all forecast horizons.
- ME and RMSE increase in the horizons of 7 and 8 quarters, for all models. The average approach performs more accurately than ARIMA one in these horizons, indicating that the forecasting accuracy increases in average approach versus a naive model. For above mentioned horizons, specific models' results are mixed, in some cases with ME and RMSE larger than those of ARIMA one suggesting low consistency accuracy for longer time horizons.

Chart 4: ME according to 1-6 quarters horizons: forecasting models versus the benchmark one



Source: Authors' calculations.

Chart 5: RMSE according to 1-6 quarter horizons: forecasting models versus the benchmark one



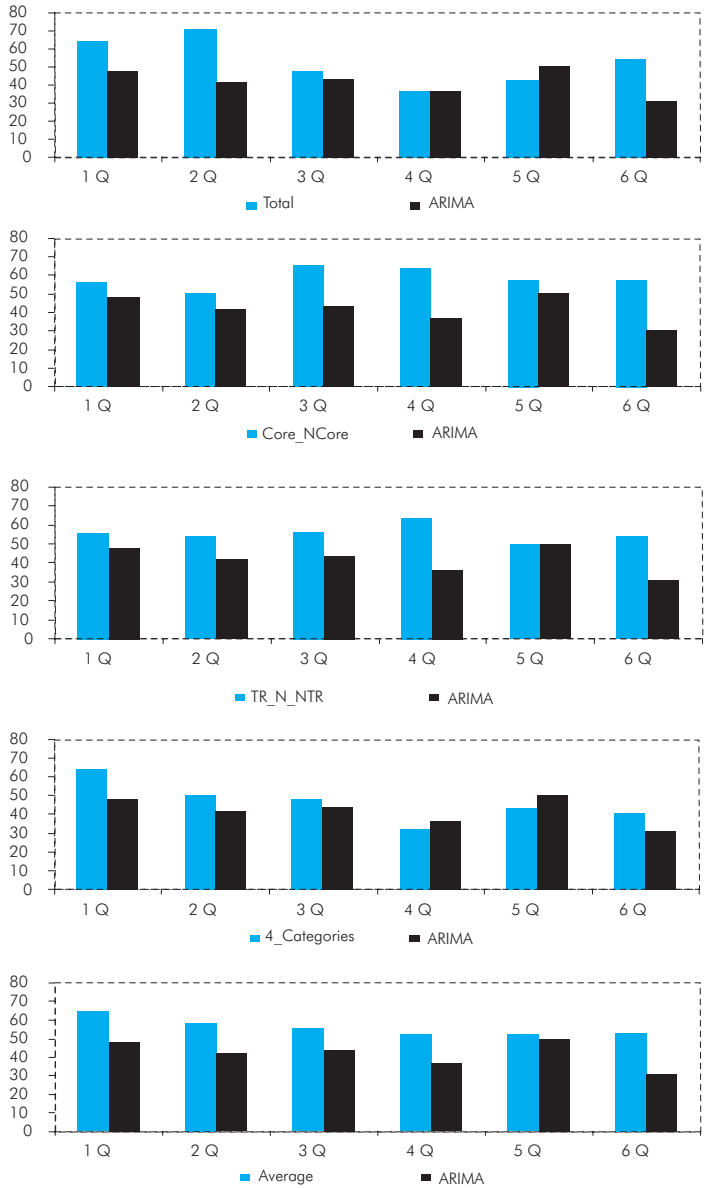
Source: Authors' calculations.

Extending the forecasting performance analysis until 2012 has enabled the analysis of direction forecast indicator (FD) for a horizon of up to 6 quarters[17]. Results indicate that:

- Over the horizon of 1-4 quarters, the direction is better captured from all models than the ARIMA one. Over this horizon, this feature has continued to be preserved, with some exceptions in two of the models (total and 4 categories). Comparing the FDs models with the ARIMA one, indicates that the additional economic information in the models has helped in signalling the right direction of the average inflation forecast over the 6-quarter horizon.
- The models which have demonstrated higher FD levels remain C_NC and TR_N_NTR. During the period under analysis, both of models have predicted in the same direction as verified by the published inflation, approximately in 65% of cases, for the horizon of 3-4 quarters. The highest value of FD for C_NC model is explained by the fact that the core inflation being an important component of this model, determins in a large part the long-term inflation trend. If the shock had not occourred at the beginning of 2011, this indicator would have resulted even higher, especially for this model.
- The other models, including the average one, predict correctly the forecasting direction over the horizon of 1 - 3 quarters.
- Based on FD analysis, Andersson, M.K. (2007) emphasises that FD values are interpretable for short term forecasts (not longer than 2 quarters).

[17] In Çeliku and Hashorva (2012), the study covered the period (2006-2010) and a few data were available over four forecasting horizons to enable a meaningful FD analysis. For this reason, the results of this indicator were extended up to 4 quarters horizon.

Chart 6: FD according to 1-6 quarter horizons: forecasting models versus the benchmark one



Source: Authors' calculations.

At the conclusion of this analysis, the consistent accuracy of the average approach model according to horizons and the FD value ranging from 55% to 64%, do not suggest a particular model selection. Consequently, the risk of over or underestimation of specific models is reduced.

3.3 OPTIMALITY AND EFFICIENCY OF THE AVERAGE FORECAST - RESULTS AND ANALYSIS

Theoretically and practically, the combination of forecasts from some models is a known approach, which helps improve the predictive efficiency and optimality. This conclusion is underlined in one of the pioneers' articles on this topic (Bates and Granger, 1969). Debates on this conclusion have been numerous and spaces of his opponents have narrowed, thanks to empirical studies in this area[18]. The literature has failed to define such a combination scheme that can be performed consistently better than a point estimate of a simple arithmetic average (Gibbs, 2012). Using the simple average and other strategies to simple linear combinations of forecasts is known as "Puzzle Combination Forecast (FCP)" or a puzzle forecasting combination (Stock and Watson 2003). The preference of researchers to FCP simple strategies has been motivated by two hypotheses verification. First, focus on the practicality of the implementation of the weighting scheme, which depends on the history of forecasts. Smith and Wallis (2009) have shown that short time series (small samples) produce greater errors in estimation when weighting schemes with different weights has been applied. Moreover, they have verified that a high estimation error causes a poor forecasting performance in out of the sample forecast, when applying a weighting scheme with different weights than in the case of a scheme with equal weights.

The second hypothesis is addressed in detail by Hendry and Clements (2002) and by Aioli et al. (2010). It consists in the fact that equal weighting of the results of the forecast is more "immune"

[18] Clemen (1989), Deibold and Lopez (1996), Armstrong (2001), Timmermann (2005) etc.

to deviations caused by sudden structural changes or wrong specifications. The authors conclude that complicated weighting schemes, which are affected by the variance in time, have a clear disadvantage compared to equal weighting ones, vis-à-vis unexpected structural changes. Forecasting techniques by schemes with varying weights try to give a greater weight to the forecasts that have performed better in the past. However, structural breaks may lead to the specifications that have historically performed poorly. Consequently, they have been weighted less than the other models in the averaging process. Because of this shift, models that previously had higher weights may decrease the forecasting accuracy in average terms. The equal weighting scheme eliminates this problem, producing an average prediction "equidistant" from both more accurate forecasting models and from less accurate ones.

In this regard, in order to evaluate the inflation forecasting properties, we will rely on the simple arithmetic mean of forecasts from the models in use, following the same approach as that applied for the period 2006-2010. The main reason supporting the averaging preference is that, for the period 2006-2012, the forecasting performance results are more accurate for the average approach than for any selected model at different forecast horizons (previous section). Based on this series, a Fan-chart at a 4-quarter horizon is designed. As a graphical representation of the probability of risk assessment around the simple average of the forecasts, the result is published in monetary policy reports as an estimation of forecasted inflation interval with 90% probability after 4 quarters.

The simple average is selected because both hypotheses outlined above, in the case of the forecasting inflation at the Bank of Albania, are verified. Forecasts series is still short (28 observations). Application of the variable weighting schemes would increase the possibility of making significant errors in terms of out of sample forecasting. By addressing the second hypothesis, its application depends on the structural breaks. Initially models were estimated over period (1998-2005)[19], with relatively minor shocks for inflation and macroeconomic developments. Since 2008,

[19] Çeliku, et. al. (2006)

several shocks, originated by different sources, have occurred. Particularly, by the end of 2009 and thereafter, the economic growth rates decreased, shifting the potential growth curve down. This seems to be a structural change affecting the long-term equilibrium, headline inflation and its main components. In this context, each of the models has an advantage for the evaluation of inflation from historical and structural changes point of views in a forecasting prospective. For this reason, it is assessed that the use of equal weights in the averaging approach has helped to avoid this problem in the forecasting inflation until the end of 2012. Most likely, this approach will continue to be preferred. This preference is supported, firstly, by the short-term forecasting series. Meanwhile, the country's economy is the subject of future structural changes, whose effects are somewhat agnostic, compromising the assumptions designing process for the forecasting inflation.

Turning to the properties' analysis of this approach, a simple mean forecast will be tested, if the forecasting inflation results optimal and efficient, based on the theories of Nordhaus, 1987 and Mincer & Zarnowitz, 1969. In the forecasting performance framework, this analysis is an additional "confidence element" besides the evaluation of the forecasting accuracy. Such an approach supports the analysis regarding the degree of optimality and efficiency of monetary policy at the central banks of developed countries[20].

3.4 OPTIMALITY

The optimality testing for the period 2006-2012, compared to that of 2006-2010, is extended beyond the 4-quarter horizon, because the new forecasts have increased the number of observations. Test results continue to verify the hypothesis that the series of errors of forecasts, FE (h), where h is the forecast horizon, is unbiased. This conclusion stands for h=1 to 8, showing that, on average, the forecasts are optimal. From a theoretical point of view, the

[20] Forecasting cases in the central banks of the USA, Sweden, England, and Germany elaborated respectively: Faust et al. (2006); Andersson. M.K. et. al (2005, 2007); Central Bank of England (Inflation Report, August, 2004); Central Bank of Germany - Workshop "Modelling and forecasting at the Central Banks", in March 2010; Reserve Bank of New Zealand, http://www.rbnz.govt.nz

fulfilment of this condition shows that average forecasts are equal to the true value (published) inflation. This property shows that over the period under review, there have been no systematic errors. Despite deviations below or above the published values, on average, they have resulted statistically insignificant. The following table shows the test results for the statistical significance of the constant in the error term forecast series for h=1,…,8. Clearly, for h=3 and 4, the probability for having a large value of the constant term in FE series results very small. Moreover, the constant value decreases until 0.01. The constant terms are insignificant for h>4, despite their increase. In line with quantitative assessment of the forecast errors series (previous section), the test results suggest a forecast horizon no longer than 5-6 quarters for this approach, the average one. This judgment, takes into consideration the increase the constant value in the forecasting errors series.

Table 1: Test results for the constant term.*

Horizon (h)	Number of observations	Constant	t-statistic	Probabilities
1	28	-0.10	-0.96	0.35
2	27	-0.12	-0.74	0.47
3	26	-0.05	-0.28	0.78
4	25	0.01	0.04	0.97
5	16**	0.26	0.93	0.37
6	15	0.42	1.44	0.17
7	14	0.42	1.36	0.20
8	13	0.29	0.95	0.37

Note:*H0: c=0. Unbiased prediction
** Forecast for h> 4 since 2008 Q4, hence, nine observations less from h=4 to h=5.
Source: Authors' calculations.

- The evidence of unbiased forecasting errors series for the period 2006-2012, extended up to h=6, supports the verification procedures of the other properties which would fulfil the degree of optimality framework in forecasting inflation.

- Forecasts remain optimal when generate forecast errors FE(h), which do not include MA(q) process over the horizons q>=h. So MA(q) should generally be insignificant. FE(h) should generate a process MA(q), where q<h. Summary of test results

in Table 2, shows the fulfilment of test for h = 1 to 4, with two exceptions (highlighted values). Under this test, the optimality condition tested for h=5 and 6 resulted entirely fulfilled.

Table 2: Regress results for MA(q) process of FE(h)[+]

Horizon (h)	MA(q)	t-Statistic	Probabilities
1	MA(1)	-1.76	0.11
	MA(2)	-1.30	0.21
2	MA(1)	2.02	0.06**
	MA(2)	-1.17	0.25
3	MA(2)	-2.49	0.02***
	MA(3)	-1.42	0.17
	MA(4)	-2.49	0.02
	MA(5)	-1.47	0.16
4	MA(3)	-2.76	0.02***
	MA(4)	0.67	0.52
	MA(5)	-3.82	0.01
	MA(6)	-0.83	0.43
5	MA(4)	-2.76	0.02***
	MA(5)	0.67	0.52
	MA(6)	-1.62	0.11
	MA(7)	-0.83	0.43
6	MA(5)	-0.76	0.47
	MA(6)	-0.36	0.73
	MA(7)	-0.38	0.71
	MA(8)	-0.63	0.54

Note: [+]MA(q>=h), no significant. So, MA(q<(h-1)), significant
Source: Authors' calculation

- According to the conclusions of the performance for 2006-2010, this condition is fulfilled for a shorter periods of time (h=1 and 2) and partly for longer time horizons. But, knowing that the process of evaluation, step by step reduces the number of degrees of freedom with increasing order of MA order and forecast horizon, distant horizons estimates should be considered with caution, as a result of reducing the number of observations.

- The third condition, that average forecasting approach

is optimal, consists in verifying the absence of increasing variance component of errors in time, under different forecast horizons. The series of forecasts errors in h=1 to 6 time horizon, have been tested whether they have a trend. The regression results in h=1, 2, 3,4,5,6 reject the presence of trend component (Table 3).

Table 3: Regression results: Trend of the forecasting errors: FE(h) dependent variable

Horizon (h)	Independent variable	Coefficient	Standard Error	t-Statistic	Probabilities
1	TREND	0.00	0.01	-0.23	0.82
2	TREND	0.01	0.02	0.33	0.74
3	TREND	0.00	0.03	0.04	0.97
4	TREND	0.00	0.03	-0.07	0.94
5	TREND	-0.08	0.07	-1.26	0.23
6	TREND	-0.10	0.07	-1.49	0.13

Source: Authors' calculations.

- Although increasing deviations along the horizons for the period 2006-2012, the heteroscedasticity tests on residuals (Resid) reject the hypothesis that the growth has been generated by widening of the variance errors over time. Errors are homoscedastic and their small growth is caused by factors outside the models (for example by the assumptions involved as a result of high economic uncertainty, unexpected shocks to inflation and its determinants). This finding was expected, as long as the trend of Fe (h) series resulted statistically insignificant.

Table 4: Heteroscedasticity test results: ARCH for Resid^2

Horizon (h)	Resid^2	Coefficient	Standard Error	t-Statistic	Probabilities
1	Resid^2(-1)	-0.01	0.21	-0.05	0.96
2	Resid^2(-1)	0.02	0.21	0.12	0.91
3	Resid^2(-1)	0.03	0.22	0.12	0.91
4	Resid^2(-1)	-0.05	0.23	-0.23	0.82
5	Resid^2(-1)	-0.06	0.25	-0.23	0.82
6	Resid^2(-1)	-0.03	0.31	-0.11	0.92

Source: Authors' calculations.

At the conclusion of this testing stage, it results that the average inflation forecast has maintained and consolidated the property of optimality at a 4-quarter horizon for the period 2006-2012. This testing round highlights that this forecast was optimal at a 6-quarter horizon. Meanwhile till 2010, it resulted partly optimal due to the smaller number of observations.

3.5 EFFICIENCY

According to Nordhaus (1987), the concept of efficiency is highly correlated with statistical sufficiency. In this sense, a forecast may be highly or less efficient. When efficiency is high, the forecast would minimize the loss function, which is subject of using the entire available information in forecasting. When efficiency is low, the loss function fails to minimize, because often at the forecast time, both the past and revised forecasts are included as statistical information. In this case, the risk of correlating forecast errors with those derived from the revision process becomes higher. Correlation of errors makes them in some way predictable by a given model, increasing the error size of the forecast.

- In the case of Albania and other countries, inflation series are not revised. The forecasting efficiency is measured in an econometrical context of conditional forecasts (Faust and Wright, 2006). In these cases, it is deduced whether central banks have used the information efficiently, while keeping the key interest rate at a certain level. This assessment can be transformed assuming, as an intermediate information for inflation within a quarter, the first two monthly inflation rates until the third month, excluding the respective monthly forecasts. This information and additional new information known until the forecast process begins are used to conduct a new round forecast or a monthly update of the quarterly forecasts, which will be quantified in the forecasted value (Forec(h)). In equation (1), the parameters a_0 and a_1 should result zero, according to the testing process and Wald test.

$$FE_t(h)_{,t} = a_0 + a_1 * Forec(h)_{,t} + u_t \quad (1)$$

Where $FE_t(h)$ is the forecast error conducted at the time (t) for the horizon (h); Forec (h),t, is the forecast and u_t is the residual/ error term.

This means that the forecast error will not be modelled according to a particular and significant linear relationship. The errors remain significantly unpredictable and uncorrelated with forecasts. The test results are fully verified for h=1 to 4. For longer horizons, the results are not reliable, also due to sample reduction.

Table 5: Results of estimation for error unpredictability

Variable	Coefficients	Standard Error	t-Statistic	Probability
Constant	a_0 = 0.04	0.47	0.08	0.94
Forec(1)	a_1 = -0.04	0.15	-0.29	0.77
Constant	a_0 = 1.10	0.81	1.37	0.18
Forec (2)	a_1 = -0.40	0.26	-1.54	0.14
Constant	a_0 = 0.15	0.51	0.29	0.14
Forec (3)	a_1 = -0.54	0.36	-1.50	0.13
Constant	a_0 = 0.75	0.43	1.76	0.16
Forec (4)	a_1 = -0.62	0.48	-1.28	0.18

Source: Authors' calculations.

- Meanwhile, regarding Mincer-Zarnowitz regression, the efficiency property is verified for forecast horizon h = 1 and 5. Below are the results for h = 1 and h = 5.

Table 6: Results of the estimates with Mincer-Zarnowitz regression

h=1

Dependent Variable: INF_1				
Method: Least Squares				
Dependent Variable: INF_1				
Method: Least Squares				
HAC standard errors & covariance (Bartlettkernel, Newey-Westfixed				
bandwidth = 3.0000)				
INF_1 = C(1) + C(2)* FOREC1				
	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	0.035307	0.308463	0.11446	0.9099
C(2)	0.956141	0.094893	10.07595	0.0000
R-squared	0.637589			

Wald Test Statistic	Value	Probability	
F-statistic	0.650354	0.5312	
Chi-square	1.300708	0.5219	
Null Hypothesis: C(1)=0, C(2)=1			
Null Hypothesis Summary:			
Normalized Restriction (= 0)		Value	Std. Err.
C(1)		0.035307	0.308463
-1 + C(2)		-0.04386	0.094893

h=5

Dependent Variable: INF_5				
Method: Least Squares				
Included observations: 10 after adjustments				
HAC standard errors & covariance (Bartlettkernel, Newey-Westfixed bandwidth = 3.0000)				
INF_5 = C(1)+C(2)*FOREC5				
	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	1.57541	1.44704	1.088712	0.308
C(2)	0.473984	0.452371	1.047778	0.3254
R-squared	0.35			

Wald Test:	Value	Probability	
F-statistic	0.687566	0.5302	
Chi-square	1.375132	0.5028	
Null Hypothesis: C(1)=0, C(2)=1			
Null Hypothesis Summary:			
Normalized Restriction (= 0)		Value	Std. Err.
C(1)		1.57541	1.44704
-1 + C(2)		-0.52602	0.452371

Source: Authors' calculations.

Overall, the forecasts for 2006-2012, have preserved the efficiency. Over short-time horizons, it appears higher, meanwhile weakens for longer ones. This has happened, first, due to the lack of information at the time of the forecasts, and, secondly, due to unexpected events in domestic economy and in foreign markets.

4. COMPARATIVE OVERVIEW: 2006-2010 VERSUS 2006-2012

The results of examinations presented in this paper are consistent with those on the inflation performance study at the Bank of Albania for 2006-2010.

4.1 COMPARATIVE ESTIMATIONS

- In terms of forecasting accuracy, indicators are similar to those resulting previously (2006-2010), revealing that the models have forecasted at almost the same accuracy level. This means that the additional period 2011-2012, has not altered the previous results, on average terms and by horizons.
- The indicator of forecasting direction has resulted slightly lower than that of 2006 to 2010, from a maximum accuracy of 70% to about 65%. This deviation was mainly driven by the unexpected inflation reduction in early 2012, as a result of the seasonal factor disordering and the continuous domestic demand weakening. The latter was reflected in slowing growth rates of monetary aggregates, credit, fiscal expenditures, etc.
- The period 2006-2012 shows that optimality for the average inflation forecast has been strengthened. The test results were most convincing. On the other hand, the forecast horizon during which the average inflation forecast is optimal has been extended. Until 2010, it was partly optimal up to six quarters even due to the smaller size sample; for 2006 -2012; econometric estimations strongly verify the optimality of the inflation forecasts at a 6–quarter horizon.
- The results of estimates indicate improved efficiency forecasts compared to those of the period 2006-2010. However, they are not highly consistent across horizons. For 2006-2012, the average forecast series has resulted efficient at 1 and 5-quarter horizon.
- The efficiency weakened as the forecast horizon increased. The efficiency weakened for longer horizons because of: lack information at the time when a round of forecast is conducted; unexpected developments in the domestic and foreign

economy. The second reason is identified as a damaging factor for the forecasts efficiency even in case of the central Bank of England and U.S. Federal Reserve, as analysed by Faust and Wright (2006). According the authors, during the periods of high economic uncertainty, the forecast efficiency deteriorates, even in medium-term time horizons; meanwhile, for the near future the forecast maintains this property. In the case of Albania, in inflation forecasting for the period under review, the property is fully verified at the first horizon, partly for the second one and fully at a 5-quarter horizon. Meanwhile, for 2006-2010, forecasts were efficient up to 2-quarter horizon, in average terms.

- The statistical indicators for the mean forecast deviation series, at a 4-quarter horizon, resulting with minimum mean forecast error, indicates lower values of the variance over 2006-2012 compared to 2006-2010. This owes mainly to the reduction of the standard deviation, during the period under review.
- The volatility indicator results around 2 times higher for the published inflation, compared to the forecast one, due to unexpected shocks on inflation (Table 7). The information on their occurrence has been quite partial or unavailable at the time of the inflation forecast for 4 quarters ahead – unexpected shocks in terms of time and size.

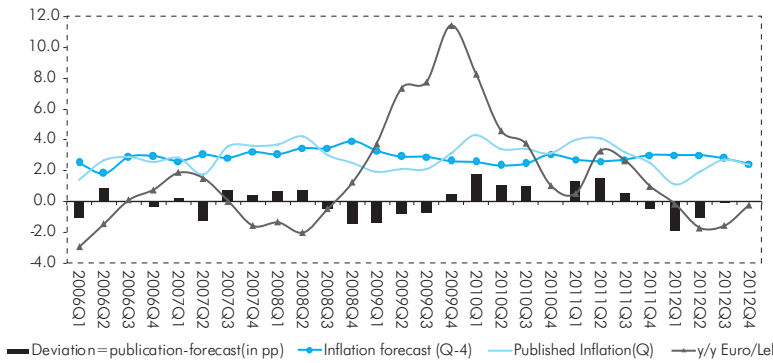
Table 7: Volatility indicators

Indicators	Horizons	
	2006-2010	2006-2012
Inflation forecast		
Mean	2.89	2.85
Standard deviation	0.47	0.41
Coefficient of variance (in %)	16.2%	14.3%
Published inflation		
Mean	2.90	2.86
Standard deviation	0.79	0.85
Coefficient of variance (in %)	27.3%	29.6%
Deviation (published-forecast)		
Mean (in pp)	0.02	0.00
Standard deviation (in pp)	0.92	0.98

Source: Authors' calculations.

- The statistical indicators for the series of deviations (errors) are improved for the period 2006-2012. This improvement is not only thanks to the higher number of observations, but also to balancing effect between mean errors values. The mean forecast error of 2011-2012 has been offset by the slightly positive mean error (0.02) of 2006-2010. In the meantime, the standard deviation of the forecast errors series is closer to 1 percentage point, indicating that the average forecast error of inflation has ranged within an appropriate statistical interval, providing an acceptable confidence from the forecasting models in use.

Chart 7: Deviation: Inflation in Q versus forecast in (Q-4)



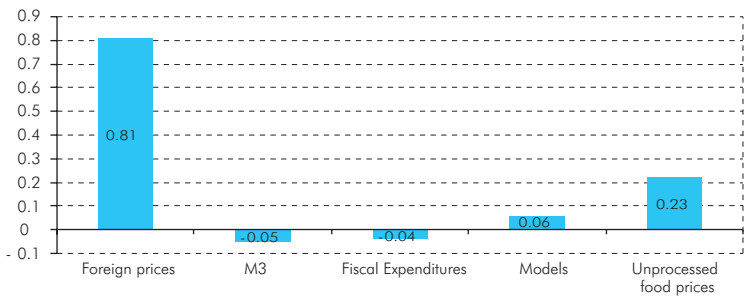
Source: INSTAT, Bank of Albania and authors' calculations.

4.2 THE MAIN SOURCES OF DEVIATIONS

The decomposition of deviation is analysed by the main factors in ex-post terms. By replacing the actual values of each explanatory variable in the respective assumptions across different forecasting horizons, while other assumptions are kept unchanged, the deviation by lower or higher assumptions made for each factor is calculated. This analysis shows that, in 2011, deviations derived largely from lower assumptions made over 2010, regarding foreign prices, mainly of processed foods and cereals. These created a positive accumulated deviation (positive error) at about 2.5 percentage

points to the annual inflation rates. This size of error was partially offset by higher assumptions for monetary aggregates (M3) and fiscal expenditures. According to the projection in 2010, M3 growth rate was assumed at 10% for 2011. At the end of this year, it resulted approximately at 8 %, and even lower at the end of 2012 (about 5 %). The forecast growth rates for fiscal expenditures dropped also. The decelerating growth rates of these indicators, keeping all the other factors unchanged, caused a negative deviation of inflation from initial forecasts at a 4-quarter horizon. The accumulated total deviation for 2011, by main components, is shown in Chart 8.

Chart 8: Decomposition of accumulated forecast error: 2011*

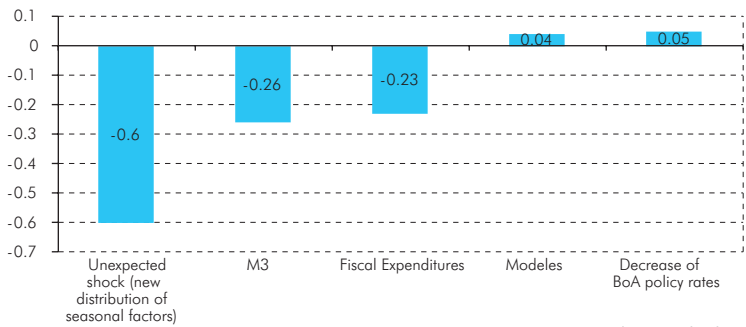


Source: Authors' calculations.
Note: * For the components of deviation by main factors, the sign is maintained to indicate the direction of the deviation caused by a particular factor to the total one.

In 2012, the deviations in average terms and in accumulated form resulted with a negative sign because of higher assumptions being than actual figures for the monetary aggregates and fiscal expenditures, contraction of aggregate demand, and disorderly distribution of seasonal factors. Similarly, the assumptions for T-bills yields of (12 months) for the first half of 2012 deviated from the actual ones. The contributing factors which improved forecasting performance were, in particular, the almost accurate forecast of the exchange rate, oil prices, the effects from increases on excises and national taxes for oil and fuels on CPI. Meanwhile estimates of business confidence surveys helped to create a judgment for future conditions of the economic activity

and labour market. Starting from the second half of 2012, a satellite model was created to forecast T-Bills yield (12-month). They included information from the fiscal sector and experts' judgments, enhancing the forecasting accuracy of the core inflation model and two-sectorial one. The total deviation for 2012 by main factors is represented in Chart 9.

Chart 9: Decomposition of accumulated forecast error: 2012*



Source: Authors' calculations.

Note: *For the components of deviation by main variables, the sign is maintained to indicate the direction of the deviation caused by a particular factor to the total one.

4.3 BALANCE OF RISKS AND RISKS SCENARIOS FORMULATION: 2011-2012

The period 2011 - 2012 was characterized by increased economic uncertainties originating from domestic and foreign markets. They have been reflected in the real, financial and fiscal sectors' developments. The baseline average inflation forecasts were surrounded by downward or upward risk probability levels, from the central value. The range of inflation forecasts with 90% probability, at a 4-quarter horizon, for 2011 and 2012, are shown in the Table 8.

Table 8: Inflation forecasts from fan chart results versus published one

	Central forecast (Q-4)	Published inflation (Q)	Inflation forecast interval with 90% probability in (Q-4)
2011:Q1	2.6	4.0	1.1 - 3.8
2011:Q2	2.2	4.1	0.8 - 3.5
2011:Q3	2.6	3.2	1.2 - 3.9
2011:Q4	3.0	2.5	1.6 - 3.9
2012:Q1	3.3	1.1	2.1 - 4.2
2012:Q2	3.0	1.9	1.6 - 3.9
2012:Q3	2.8	2.7	1.4 - 3.6
2012:Q4	2.4	2.4	1.0 - 3.3

Source: INSTAT and authors' calculations.

Unexpected shocks to inflation are reflected not only in failure to achieve the central forecast value, but also the forecast range for the first half of 2011 and first quarter of 2012. Overall, these were considered as transitory shocks to inflation, associated with +/- 5% probability. They show that deviations are caused almost entirely by the lack of information at the time Q-4, when the assumptions have been designed. The enlargement of the fan-chart indicates higher economic uncertainties for inflation forecasting over the period 2011-2012.

The process of inflation forecasting is associated with results analysis of risk scenarios around the average forecast resulting from baseline scenarios. In line with current and expected developments in the economy, based on the economists and policy makers' judgments, the risk scenarios are designed. Their results have impacted not only the inflation rates, but also the economic growth ones conditioned by a certain level of policy interest rate. Appendix 2 presents more detailed information about these scenarios and their effects, mainly on inflation.

Under the conditions of low inflation forecasts, the presence of modest risks to inflationary pressures from the demand side and from second-round effects, while the assessments for inflation expectations have fluctuated within a moderate range of values, the other scenarios are focused on increased risks: in lending activity; fiscal developments; and macro-financial performance indicators. This process has primarily aimed at quantifying potential risks to

inflation and economic growth, and investigating the developments in the baseline scenario under alternative monetary policy options. Estimates of the impact of interest rate cuts have contributed to the decision making process for supporting the recovery of economic activity and domestic demand under low inflationary pressures risks. In general, designing risk scenarios has been a consistent process that has involved the real, monetary, fiscal and external sectors of the economy. During 2011-2012 additional uncertainties were experienced. It also seems that most of the risk scenarios are verified by replacing sequentially some of the baseline ones. Some of the most important ones relate to the formulations for: the monetary sector – lower growth rates of the monetary aggregates as a result of stagnation in lending activity; fiscal sector-budgetary expenditure reduction and behavioural modification of government borrowing. Results of risk scenarios for the above shocks and lowering interest rates are verified in a second time.

The consistency of baseline and risk scenarios is provided through results from the short-term models for inflation and GDP growth, the effects measured by macroeconomic models (MEAM) and Gap, and involving projections from fiscal and financial sectors.

Besides alternative scenarios in the fiscal and monetary sector, several scenarios are also considered for the risk of exchange rate depreciation, as a result of the potential imbalance of the balance of payments, but they are not verified. Exchange rate forecasts confirmed the baseline scenario results during the last two years.

5. CONCLUSIONS AND RECOMMENDATIONS

Inflation forecasting is presented in detail to Bank of Albania's decision-making structures. Although it is only one of the components in the process of formulation and evaluation of the monetary policy, it is highly important[21]. Forecasting is becoming increasingly important in the activity of central banks, whose objective is to maintain price stability and is associated with periodic publication of forecasting inflation and other indicators closely related to it[22].

5.1 CONCLUSIONS

The Bank of Albania has enhanced its transparency on inflation forecasting. Publication of research papers on this process, models development and forecasting performance during 2006-2012 have supported the important step of publishing the forecast, as an interval of values with the associated probability of uncertainties in 2012. These developments have contributed all along to building inflation expectations and fostering the transparency and credibility of the central bank.

The view of using projections has expanded over time. During 2011-2012, the existing trend of enriching and improving forecasts by short-term models continued. Above all, it has provided the decision-making process with quantitative estimates and trends of balances for inflation risks over the course of monetary policy action. On the other hand, it has aimed at providing a reliable "basis" for the most consistent forecasts in the medium term through semi-structural models.

The inflation forecast performance analysis during 2006-2012 shows that the models have continued to perform within the acceptable limits of errors, ensuring continuous reliability of forecasting inflation. The period 2011-2012 was characterized by supply-side shocks, relatively transitory and a partial materialization

[21] http://www.rbnz.govt.nz/monpol/review/0096438.html; http://www.riksbank.se/Documents/Rapporter/UUP/2012/rap_uup2011_120404_eng.pdf

[22] http://www.rbnz.govt.nz/monpol/review/0095532.html

of the second-round effects on inflation. The shocks in 2011 were partially offset by persistent factors of vulnerable demand. As for 2012, the impact of supply factors deepened further due to slowing demand.

Under these conditions, the main deviations are caused from lower prices forecasted by international institutions for commodities in global markets, at the time of performing the rounds of our forecasts for inflation in late 2009 and early 2010. Meanwhile, the effects of administrative measures in late 2011 and seasonal disturbance profile in the first half of 2012 caused temporary deviations from the inflation behaviour forecasted a year earlier.

Despite the above developments, the inflation forecast performance under current models, shows that all models at the horizon of 1-6 quarters, predict more accurately than the benchmark model. The average model reaches the highest accuracy in this time horizon, reinforcing the conclusions drawn from the study of the performance for 2006-2010. It is in line with the conclusions of global studies: the approach by a simple average of the forecasts is what ensures the minimum of errors, mainly in terms of not too long time series and the presence of structural economic shocks.

The models accurately predicted the direction of inflation to an extent comparable to that of 2006-2010. The correct direction during 2006-2012, was captured on average in about 65% of the cases, slightly down from the level of this indicator for 2006-2010. The reduction was caused mainly by the sudden decline of inflation rates in late 2011 and early 2012. For 2013 onwards, a new estimation of seasonal behaviour might contribute the increased accuracy of forecasted inflation, mainly that of unprocessed food category.

Statistical indicators of the forecast average deviation series up to 4-quarter horizon indicate reduced values of the variance for 2006-2012, due to declining standard deviation throughout the analysis period. Econometric estimates fully support the property of optimality at the 6-quarter horizon. For the years 2006-2012, estimates for inflation forecasting efficiency were improved compared to the

period 2006-2010. However, they are not characterized by a high consistency among horizons. As the forecast horizon increased, the efficiency became weak. The weakening efficiency for the longer-term horizons is characteristic of forecasts under high economic uncertainty.

Concluding, the monetary policy decision-making during 2011-2012 was based on accurately and stable inflation forecasting. Models have provided optimal forecasts at a 6-quarter horizon and relatively efficient forecasts at shorter horizons. During the period 2011-2012, consistent risk scenarios were developed around the baseline one, due to increasing economic uncertainty for the future. For a certain number of assumptions on demand factors, developments by risk scenarios are verified. This decision helped formulating a cautious and forward-looking monetary policy stance, on developments in inflation, the financial and real sectors of the economy.

5.2 RECOMMENDATIONS

The analysis requires full information and selected statistical indicators on the economy at the time of the inflation forecast[23]. Although the monetary policy action expands in the medium-term horizon, i.e., the policy-relevant horizon, it is very important to have a comprehensive understanding of the current situation and the near future of the economy and inflation, in particular. Short-term fluctuations in the economic may have significant implications in the medium term. A shock to the business confidence indicator may affect real decisions, such as investment and employment levels, which within a normal time-lag, may affect demand and inflationary pressures over the policy-relevant horizon.

Short-term forecast consolidates judgment on initial conditions. Econometric models and economic considerations should be used to generate estimates of inflation along with those for economic activity for the current quarter and the first two quarters of the forecasted period. These three quarters in the language of

[23] http://www.rbnz.govt.nz/monpol/review/0097155.html.

forecasting process are called "monitoring quarters" for the whole process in the medium-term horizon.

The follow up of the performance of forecasting inflation is a process that must have the same wave length with the forecast process. This means that the forecast is a working process development, aiming to increase the forecasting accuracy.

Inflation forecast and its performance might be transmitted to the public through a careful communications strategy. This will be achieved through an optimal balance between the transparency of the forecast publication and the boosting the public confidence in the Bank of Albania.

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APPENDIX 1. RESULTS OF PERFORMANCE INDICATORS

	Indicators	1 Q	2 Q	3 Q	4 Q	5 Q	6 Q	7 Q	8 Q
Total	ME	-0,10	0,14	-0,17	-0,22	0,19	0,27	0,22	0,00
	MAE	0,49	0,72	0,87	0,93	0,86	0,82	0,80	0,67
	RMSE	**0,62**	**0,87**	**1,05**	**1,15**	**1,10**	**1,05**	**1,01**	**0,83**
	RMSEN	0,19	0,31	0,44	0,49	0,88	0,84	0,78	0,76
	CVRMSE	0,21	0,28	0,34	0,38	0,41	0,40	0,38	0,30
	FD (%)	64	71	48	36	43	54		
4_Categories	ME	-0,23	0,24	-0,26	-0,10	0,21	0,44	0,42	0,36
	MAE	0,40	0,63	0,78	0,96	0,89	0,85	0,92	0,80
	RMSE	**0,52**	**0,80**	**1,00**	**1,17**	**1,07**	**1,06**	**1,12**	**1,07**
	RMSEN	0,17	0,27	0,38	0,43	0,67	0,51	0,53	0,53
	CVRMSE	0,17	0,25	0,32	0,39	0,40	0,42	0,43	0,34
	FD (%)	64	50	48	32	43	41		
Core_Ncore	ME	-0,10	0,18	-0,03	0,05	0,38	0,36	0,40	0,45
	MAE	0,46	0,78	0,91	1,10	1,06	1,02	1,07	0,99
	RMSE	**0,57**	**0,91**	**1,08**	**1,20**	**1,24**	**1,23**	**1,31**	**1,23**
	RMSEN	0,18	0,29	0,45	0,55	0,82	0,72	0,77	0,82
	CVRMSE	0,19	0,29	0,37	0,46	0,50	0,51	0,55	0,52
	FD (%)	56	50	65	64	57	57		
TR_N_NTR	ME	0,02	0,01	0,13	0,23	0,25	0,39	0,41	0,25
	MAE	0,40	0,66	0,70	0,70	0,73	0,82	0,84	0,84
	RMSE	**0,40**	**0,75**	**0,89**	**0,81**	**0,71**	**1,17**	**1,28**	**1,32**
	RMSEN	0,21	0,33	0,35	0,33	0,37	0,51	0,63	0,60
	CVRMSE	0,20	0,29	0,34	0,34	0,33	0,43	0,45	0,45
	FD (%)	56	54	57	64	50	54		
Average	ME	-0,10	0,12	-0,06	0,01	0,26	0,30	0,42	0,30
	MAE	0,40	0,62	0,76	0,87	0,86	0,86	0,86	0,80
	RMSE	**0,51**	**0,79**	**0,94**	**1,02**	**1,02**	**1,08**	**1,11**	**1,03**
	RMSEN	0,19	0,28	0,42	0,49	0,80	0,64	0,81	0,79
	CVRMSE	0,17	0,26	0,32	0,36	0,39	0,43	0,44	0,40
	FD (%)	64	58	55	52	52	53		
Arima	ME	0,07	-0,19	0,25	0,26	0,45	0,45	0,41	0,31
	MAE	0,88	1,04	0,96	0,95	0,80	0,84	0,88	0,78
	RMSE	**1,01**	**1,16**	**1,11**	**1,30**	**1,30**	**1,25**	**1,13**	**1,25**
	RMSEN	0,24	0,30	0,56	0,58	1,38	1,76	2,23	4,02
	CVRMSE	0,35	0,40	0,40	0,43	0,38	0,38	0,40	0,37
	FD (%)	48	42	43	36	50	31		
RRMSE	Total	0,61	0,74	0,94	0,88	0,84	0,84	0,89	0,66
	4_Categories	0,51	0,69	0,90	0,90	0,82	0,85	0,99	0,86
	Core_Ncore	0,57	0,78	0,97	0,92	0,95	0,98	1,16	0,99
	TR_N_NTR	0,39	0,64	0,80	0,62	0,55	0,93	1,13	1,05
	Average	0,50	0,68	0,84	0,79	0,79	0,86	0,98	0,82

Source: Authors' calculations.

APPENDIX 2. RISK SCENARIOS: 2011 - 2012

Risk scenarios, simulations and scenarios based on initial conditions	Summary description
I risk scenario	Greek crisis' impact on the local economy - worsening domestic consumption condition as a result of declining remittances and domestic exports in terms of a lower foreign demand.
II scenario	Greek crisis impact on liquidity, in the capital adequacy ratio, the cost of borrowing, loans and capital levels in the banking sector.
I risk scenario	Increased capital from the banking system.
II scenario	Growth on liquidity.
I risk scenario	Economic growth, translated into a more narrowed negative output gap generated as a result of increased consumption.
II scenario	Increased private investment is expected to bring economic growth, which will contribute to the narrowing of the output gap.
III scenario	The exchange rate will be depreciated with a higher rate in the first year of the forecast horizon
I simulation	Reduction on the interest rate by 0.5 p.p. for two years, coupled with a depreciation of the exchange rate, to continue with its gradual appreciation.
II simulation	Reduction on the interest rate to the same extent, while the exchange rate reacts after four quarters, being depreciated gradually to 1%, to make room for a subsequent gradual appreciation.
Initial condition	Contraction in credit growth and a stop of remittances sent by emigrants in Greece, in a situation where the current account is not corrected and also in terms of a correction to its potential.
I risk scenario	Observance by the Ministry of Finance of the planned budget deficit to 3% of GDP.
II scenario	Exceed by the Ministry of Finance of the planned budget deficit to 3% of GDP.
I risk scenario	No materialization of the level of projected revenues in terms of slower growth of GDP and the impossibility to finance the budget deficit.
I risk scenario	Gradual 10% depreciation of the exchange rate, estimated by the MEAM model. Gradual 10% depreciation of the exchange rate, estimated by the GAP model.
Initial condition	Projections for GDP components, GDP and inflation for the years 2011, 2012, 2013.
Initial condition	Depreciation of the exchange rate.
Initial condition	Slower growth of credit.
Initial condition	Identifying the main factor that influence the decline of inflation: demand, supply or inflationary expectations.
I risk scenario	Lower growth of credit.

II scenario	Budget spending cuts in order to maintain the planned budget deficit.
III scenario	Combining the above two shocks.
Initial condition	The forecasted level of revenues by three methods in terms of lower projections for economic growth rate, as well as potential corrections budget spending level in order to fulfil the objective of the budget deficit.
Initial condition	Projections regarding the overall performance of the economy for the years 2012- 2013.
Initial condition	On the substance of risk scenarios was the possibility of transmission of economic and financial difficulties of Greece and Italy together, through: trade channel (drop in exports to Greece and Italy, as well as the reduction of imports destined for further processing in Albania and re-export them in Greece and Italy), channel foreign direct investment (inflows decline by Greece and Italy), the credit channel (drop of the credit stock originating from Greece and Italy).
Initial condition	Estimates of aggregate demand, its components and inflation during 2012 -2013.
I risk scenario	Slower growth of credit.
II risk scenario	Depreciation of the exchange rate.
I risk scenario	The reduction in interest rates, exchange rate unchanged.
II scenario	Depreciation of the exchange rate, while the interest rate remains unchanged.
III scenario	Simultaneous reduction of the interest rate and exchange rate depreciation.
Initial condition	Privatization of Albpetrol and its impact on the domestic economy.
Initial condition	Quarterly estimates of aggregate demand, its components and inflation during 2012 and 2013.
Initial condition	The impact on the financial system and economic activity, if arrears of government are paid, at the level of government loans.
Initial condition	Review of quarterly estimates for aggregate demand, its components, inflation for the years 2012-2013 (to include new information regarding the draft of 2013 and expectations for lower rates of credit growth by banks).
I risk scenario	Further slowdown in credit expansion.
II scenario	Increased public debt limit to GDP beyond 60%.
Initial condition	Risk scenario associated with the reduction of private spending.

Source: Summary of various meetings Advisory Monetary Policy Committee (ACIMP).
Note:Shades have been made to distinguish risk scenarios from simulations in different rounds of forecast

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Inflation Forecasting Performance and Monetary Policy Decision-Making during 2011-2012 - /
/Çeliku Evelina; Hashorva Gent - Tiranë:
Banka e Shqipërisë, 2013

-56 f; 15.3 x 23 cm.

Bibliogr.
ISBN: 978-99956-42-97-1.

You may find this paper in the following address:

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