NEW CORE INFLATION MEASURES: THEIR USAGE IN FORECASTS AND ANALYSIS

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ABSTRACT

The practice of core inflation measures provides various approaches. Is there any perfect and universal method to measure it? Until now, no such thing has been concluded. Selecting a method on whose basis a proper core inflation series is constructed is a debatable issue in academic circles and in those of central bankers. Central banks employ different core inflation measures based on the fact: (1) whether their ultimate target is the core or the headline inflation; (ii) whether they use it or not to forecast the headline inflation. In all cases, it is aimed at selecting those methods that inform more clearly the decision-makers, economic agents and the broad public on the long-term inflation trends. This research brings about arguments related to on-going discussions at the Bank of Albania on forecasting inflation in general and core inflation in particular. This paper examines several measures of core inflation. A summary of methods, of corresponding priorities and problems is made with regard to each measure. Then, based on the outcome of some statistical criteria, on tests about the degree of basic component persistency, on the predictive abilities of core inflation measures for the headline inflation, efforts are made to evidence the optimal measure to be used under Albania's case. Based on a complete estimation process, this paper presents forecasting models of various core inflation measures, exploring the possibility to obtain through them the most accurate headline inflation forecast. Making a balance between priorities and problems of the alternatives of various core inflation measures, it is drawn the conclusion that the most appropriate measure – which simultaneously meets the statistical criteria and enables the headline inflation forecasting – is the one that permanently excludes some items from the basket. This model is preferred to be applied largely by different central banks, because of the high degree of transparency and better understanding by the public. The research concludes by providing concrete proposals for encompassing information on core inflation measures to Bank of Albania's periodical analyses on the developments of the economy in general and of prices in particular.

1. MOTIVATION

The following section aims to clarify some important issues about using current measures of core inflation at the Bank of Albania. Until the end of the year 2006 the measuring of core inflation as a trimmed mean[1] has been used, for two main purposes: to advocate monetary policy analyses; to forecast headline inflation by means of modelling the underlying and non-underlying components. It is argued from the statistical and empirical viewpoint (*Schiesser 1998; Çeliku, 2005*), that the core inflation measured by trimmed mean is a qualitatively better indicator in comparison to other measures of this category. Its use is valuable in the monetary policy decision-making process, while its involvement in forecasting headline inflation[2] constitutes a debatable issue to Bank of Albania's forecasting staff. The technique of computing the core inflation through the trimmed mean approach imposes the use of various weights across time periods for underlying and non-underlying component. This specifics has created difficulties in modelling and constructing the aggregate headline inflation from these components, because it has induced another element of uncertainty, compared to other existing models. It has turned out that a part of errors in forecasting headline inflation by means of the corresponding model comes from the presence of various weights across time periods.

In an effort to reflect in the most argumentative way about the discussions related to recommendations on inflation forecasting and more concretely on using core inflation for forecast[3], other alternative core inflation measures will be presented in this material, which are also applied by other central banks with experience in this area. Exploring the approaches, their priorities and problems in measuring various variants of core inflation is done in view of the degree of usefulness of each method in the analysing and forecasting process of the headline inflation at the Bank of Albania. The results from various statistical criteria have backed the process of estimating the degree of usefulness of the proposed methods for measuring the core inflation in Albania's case.

The assessment period is extended from January 1998 to December 2007. December 2007 coincides with the moment of

introducing the reviewed CPI basket and the rebasing process of CPI. Preliminary estimates made in 2008 indicate that changes in CPI basket weights have not brought about any statistically significant changes in the assessment of core inflation measures.

2. CORE INFLATION AND DECISION-MAKING IN MONETARY POLICY

The literature defines core inflation as the permanent, long-term part of the headline inflation. From the central bank's viewpoint, core inflation constitutes that part of headline inflation, which is caused mainly from monetary factors. Based on previous theoretical considerations, the core inflation would result after excluding from the headline inflation the short-term or transient movements, which are usually caused by factors beyond the monetary policy scope.

The practice of measuring core inflation provides a variety of approaches. The selection of the approach on whose basis an appropriate series is provided for the core inflation is a debatable issue in academic circles and in those of central bankers (Silver, 2006). The central banks use various measures to core inflation, depending on the fact: whether they have the core inflation or the headline inflation as their ultimate target; and whether they use it or not in the headline inflation forecasting process. In all cases it is aimed to select those methods that:

- Manage to prevent at maximum the transient fluctuations from the headline inflation. Though such fluctuations do not remain beyond inflation analysis, their treatment should not be determinant in the monetary policy decisions;
- Have a high degree of transparency, so that communication of this indicator is as comprehensible as possible to the public.

Application of sophisticated methods is estimated to generate qualitatively better measures of core inflation. But, such methods are less transparent and less comprehensible to the public and frequently the core inflation figure remains somewhat in the

"ownership" of a very close circle of economy experts.

Albers (2006), discussing the monetary policy at the Bank of Albania, the importance of the forecasting process and the inflation forecasting performance, emphasized that there might exist a very clear distinction between the results of the inflation forecasting models and the monetary policy decision-making process. In this context, he stresses the idea that never should the forecasts be mechanically related to the decision-making process. In the analysis he makes about the models, he comments that the forecasting model of the aggregate headline inflation (core and non-core) is useful. But, like the authors of the paper[4], he assesses that the trimmed mean approach increases the difficulties in the headline inflation forecasting process (various weights across the time) and in the public understanding of the core inflation (low transparency).

3. PROPOSED METHODS

The methods of measuring core inflation vary from the simplest to the most sophisticated ones[5]. This paper reveals the results of two new measuring methods: the permanent exclusion-based method and the reweighting one. The application of these methods is based on statistical distribution features of inflation rate deviations, according to basket items and magnitude of these deviations[6].

3.1. PERMANENT EXCLUSION-BASED METHOD

Measuring core inflation in central banks of various European countries indicates that the trimmed mean approach is optimal due to statistical features (Vega, Wynne, 2001). Notwithstanding this fact, the European Central Bank and other central banks prefer permanent exclusion-based method (PE) of some basket items. In comparison with other methods, it is easily applicable, much more transparent and comprehensible to the public. Its application would prevent the problem of weights change in the forecasting process. For these reasons, Albers and Allen (2006) assess that the use of such method is much more promising to the Bank of Albania.

Based on the permanent exclusion method, on other central bank's experiences and on economic analysis of our consumer basket price behaviour, it is assessed that the following items may be excluded from the latter one: highly seasonal services and goods that cause temporary price fluctuations (usually unprocessed food items), administered prices items; goods whose prices are frequently subject to fiscal policy; goods whose prices are closely related to the foreign conjuncture.

Table 1. List of excluded items

Fruit	(high seasonality)	unprocessed products
Vegetables, potato included	(high seasonality)	unprocessed products
Fresh fish	(seasonality)	unprocessed products
Coffee		excise good
Alcoholic beverages		excise good
Tobacco		excise good
Power		at administrated price
Water supply		at administrated price
Services to personal transport vehicles - fuel/oil		excise good; at a price influenced by international market conjuncture

Their weight to CPI basket is about 22 percent. Hence, the core inflation measurement includes almost 78 percent of basket goods and services[7]. The fact that the weights are fixed for the "core inflation" and "non-core" inflation, makes the permanent exclusion-based method simpler in forecasting the headline inflation[8]. The forecasting assumes that the core and non-core parts do not affect each-other. In a simpler sense, the part of core inflation is not expected to be affected by factors outside the monetary policy. This assumption helps include in the headline inflation forecast, such elements as: price changes of goods with a high seasonality, which are forecasted based on autoregressive models; administered price changes, based on their assumptions; excise goods price changes, based on their assumptions; fuel price changes, modelling them on the basis of international market forecasts. Each of the above components is weighted to the corresponding weight in the CPI basket.

As long as external elements have not been involved in the past[9] specifically in the forecasting process the alternative of permanent exclusion brings about a novelty, even on the headline inflation forecasting process. Relations to monetary factors, involvement in a more structured way of the external factors to the headline inflation, would help both the forecasting process and the analysis one[10].

Notwithstanding the above priorities, the concerning aspects of such a method relate to whether the excluded part carries over or not the information about the monetary/core inflation or the permanent inflation. Cechetti (2006), discussing the core USA inflation, underlines the idea that permanent exclusion of some items does not always carry within itself only the transitory inflation. It may contain information about monetary inflation, which is reflected even in the long-term inflation trend. Another limitation appears in modelling: to obtain the headline inflation, it is assumed to neglect the relations among core inflation parts, a fact that may weigh down on a more complex treatment of the interdependence among inflation components.

3.2 REWEIGHING THE CPI BASKET APPROACH

By means of the reweighing approach, none sub-item is excluded permanently[11] from the consumer basket, on which the CPI is computed. This set of methods does not fully ignore casual or transient price movements (either positive or negative), since in certain cases they may represent an internal inflationary process that should not be neglected by the monetary policy. The estimation technique of core inflation according to this method consists in trimming the contribution of sub-items that present high price volatility across the time, in the re-calculated price index. Such core inflation indices are used by the Central Bank of Canada and the Bank of England. Referring to respective approaches, we will present below the endeavours made for new measures to core inflation in Albania.

3.2.1. "Double weighting" method (DW)

In "double weighting" model (DW), every sub-item of the consumer

basket is assigned a double weight, along with the official weights to the consumer basket. The rationale here is that a smaller weight is given to sub-items, whose prices have a high volatility. The standard deviation is used as an indicator for inflation volatility. The double weight assigned to these sub-items is the inverse of the standard deviation of relative price changes. Hence, the greater the standard deviation, the smaller is the weight of the sub-item. (See Table 2)

Table 2. Sub-items, whose weights have changed more in double weighting measure

Sub-items	Weight in CPI (1)	Weight in DW (2)	Ratio (2/1)
Bread and grains	7.5	14.9	1.9
Fruit	3.9	1.2	0.3
Vegetables, potato included	6.7	2.2	0.3
Rent	1.5	0.8	0.5
Imputed rent	16.9	9.5	0.6
Energy	4.6	2.0	0.4
Services to personal transport vehicles	1.6	0.6	0.4

The table depicts that "Fruit" is a high volatility sub-item. "Vegetables, potato included" in the new index, π^{DW} account for a weight three times smaller than their official weight in the CPI basket. The opposite takes place in low volatility sub-items, such as "Bread and grains", whose prices are regarded as almost "frozen" or "negotiable". Core inflation index measured by double weighting method will be calculated as follows:

$$\pi_t^{DW} = \sum_{i=1}^{n} \pi_{it} * dw_{it}$$

where: dw_{it} is the double weight. These weights get normalised, so that their sum is equal to 1; π_i is the annual inflation rate of each sub-item *i*.

$$dw_{it} = \left\{ \frac{w_{it} * \frac{1}{\sigma^i}}{\left[\sum_{i=1}^{n} w_{it} * \frac{1}{\sigma^i} \right]} \right\}$$

where: σ^{i} is the standard deviation.

The main advantage of this method relates to the fact that each basket item is included in measuring core inflation. Along with this positive aspect, this method is loaded with subjective elements reflected in the selection of the period under which the standard deviation of relative price changes is calculated, and therefore, it is reflected in the reweighting process.

3.2.2. "Persistent weights" method (PW)

In 'persistent weights' (PW) approach, the historical 'persistence' of inflation determines the weight of each sub-item. Cutler (2001) and Blinder (1997) identify core inflation as the long-term (or persistent) component of aggregate inflation. The inflation persistence is a measurement that indicates how slowly the inflation changes in the corresponding sub-item. According to this method, the economic importance of the items (estimated by their weight to consumer basket) bears no significance in the construction of this indicator.

In order to find persistence weights, each sub-item of the basket will be estimated by a first order autoregressive model AR (1).

$$\pi_{i,t} = \alpha_i + \rho_i \pi_{i,t-12}$$

where, π_i is the inflation of the sub-item *i*.

The ρ_i coefficient is a persistence inflation indicator of each sub-item. The sub-items with $\rho_i > 0$ are included in calculating the PW core inflation index, giving an equal weight to the autoregression coefficient. These weights get normalised so that their sum is equal to 1. The sub-items with the coefficient $\rho_i < 0$ are not included in the index (assigning a zero weight)[12], because their inflation returns immediately to its mean.

Core inflation index, π^{DW}, with the persistent weight method, is calculated as follows:

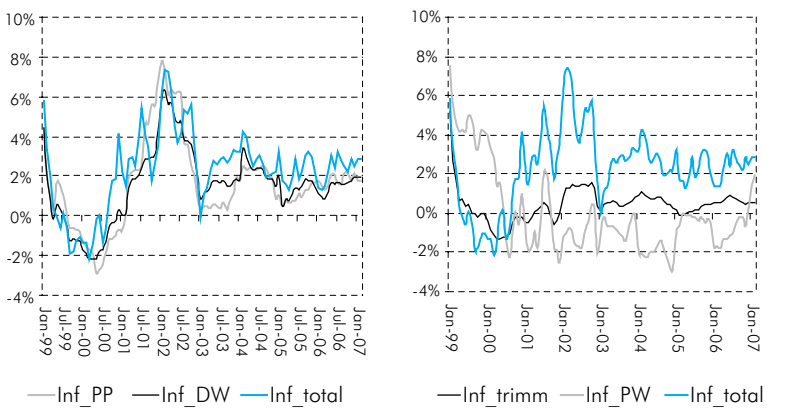
$$\pi_t^{PW} = \frac{\sum_{i \in \rho > 0} \rho_i * \pi_i^t}{\sum_{i \in \rho_{i>0}} \rho_i}$$

The persistence weights are changed each year using a rolled-forward monthly data set. The need for a lengthy time series for the estimate means that much of the data on which the estimates are based are quite unrelated to the period of the price comparison. This is problematic since the data are treated symmetrically in the estimator, with just as much influence given to remote past periods, as to past and near ones. Second, the data are overlapping so that any change in the estimated coefficients will be smoothed.

4. CORE INFLATION – A GOOD INDICATOR OF CURRENT AND FUTURE HEADLINE INFLATION TRENDS

"Ideal" core inflation is an indicator which is a good predictor of the trend of headline CPI inflation. The following section will analyse how "ideal" the above-mentioned core inflation measures are, based on the outcome of some statistical indicators.

Chart 1 Various measures of core and headline inflation on an annual basis (in %)



Source: INSTAT and authors' estimates

4.1. DOES CORE INFLATION CAPTURE PERSISTENT INFLATION MOVEMENTS OR IS IT VOLATILE?

The tables 3 and 4 show the results of statistical indicators (monthly mean, standard deviation of monthly changes and the coefficient of variation)[13] on headline inflation and on various core inflation measures. It results that in terms of volatility, for the whole period of 1999-2007, (table 3), core inflation computed on the basis of permanent exclusion-based method and the one based on double weighting present a lower volatility than the headline inflation. Both other inflation measures have a very low mean and a high standard deviation. Table 4 shows the same statistics for 2002m1-2007m12, to see how various core inflation measures perform over a low and stable inflation period. Concerning such period, core inflation volatility measured according to trimmed mean drops sharply, while the one measured according to permanent exclusion method presents a lower volatility than any other measures. The core inflation computed by persistence weights continues to be the most volatile.

Table 3. Some statistical results: 1999m1-2007m12

	Mean (1)	Standard deviation (2)	Variation coefficient (2)/(1)
Monthly headline inflation	0.2	1.3	6.5
Trimm_Infl	0.02	0.26	11.4
PE_Infl	0.13	0.45	3.6
DW_Infl	0.12	0.56	4.5
PW_Infl	0.03	2.60	84.6

Source: Authors' estimates

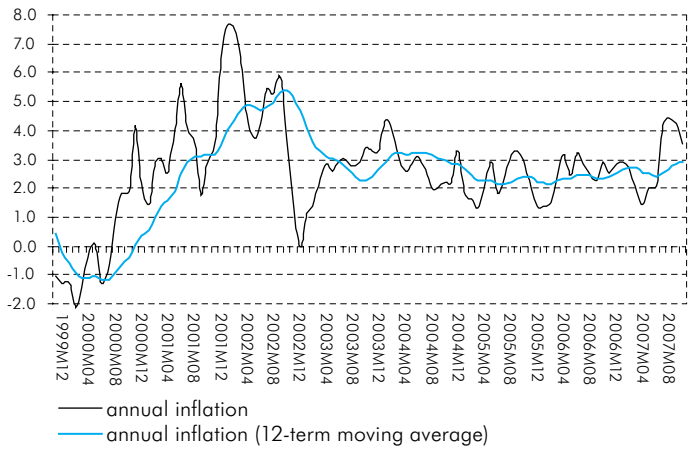
Table 4. Some statistical results: 2002m1-2007m12

	Mean (1)	Standard deviation (2)	Variation coefficient (2)/(1)
Monthly headline inflation	0. 2	1.0	5.0
Trimm_Infl	0.04	0.11	3.0
PE_Infl	0.11	0.30	2.5
DW_Infl	0.14	0.49	3.5
PW_Infl	0.04	2.87	79.0

Source: Authors' estimates

Numerous studies use the 12-term moving average benchmark of headline inflation. This benchmark will be used to calculate various measures of core inflation even in Albania's case.

Chart 2 12-month trend and overall annual inflation in % for 1999 – 2007



Source: INSTAT and authors' estimates

Table 5 depicts the results of RMSE[14] and MAD[15] indicators, which express various forms of deviation between core inflation measures and 12-month headline inflation trend. It comes out of the comparative analysis that the permanent exclusion and double weighting methods provide better statistics on core inflation, testifying a larger approximation to inflation rate trend. It is assumed here that the latter one changes gradually. To compare the descriptive statistical results of the whole period with those of a low and stable inflation period, the same analysis is made, starting from January 2002. Shortening the calculation period does not bring about obvious changes in the outcome.

Table 5 RMSE and MAD

Measuring core inflation	RMSE	MAD	RMSE	MAD
	1998m1 – 2007m12		2002m1 – 2007m12	
Trimm_Infl	0.05	0.05	0.04	0.03
PE_Infl	0.02	0.02	0.02	0.02
DW_Infl	0.02	0.02	0.02	0.01
PW_Infl	0.07	0.06	0.09	0.07

4.2 DO CORE INFLATION MEASURES HELP FORECASTING LONG-TERM INFLATION TREND?

To assess whether core inflation measures predict future inflation trend, initially, the simple linear correlation coefficient between the core inflation and the total one is computed for 6, 12 and 18 coming months.

Table 6. Correlation coefficient

		CPI		CPI $^{t+6}$		CPI $^{t+12}$		CPI $^{t+18}$	
		Monthly	Annually	Monthly	Annually	Monthly	Annually	Monthly	Annually
Trimm_Index	Annually		0.64		0.64		0.64		0.64
	Monthly	0.68		0.68		0.69		0.70	
PE_Index	Annually		0.76		0.76		0.76		0.76
	Monthly	0.39		0.39		0.39		0.40	
DW_ Index	Annually		0.90		0.90		0.90		0.90
	Monthly	0.86		0.86		0.86		0.86	
PW_Index	Annually		0.09		0.09		0.13		0.09
	Monthly	0.74		0.74		0.73		0.73	

Results of the correlation coefficients are mix, referring to (monthly/annual) change rate. The correlation coefficients for three first measures of core inflation on annual basis are relatively high, indicating that the core inflation contains information about future overall inflation movements. DW core inflation proves to be superior, both in monthly and annual terms. PW core inflation turns out to be useless for forecasting on annual basis, but it is ranked second on a monthly basis. It is worth mentioning that the correlation coefficients are generally stable over the time, indicating stability of the relation between these measures and the overall inflation.

4.2.1 A simple model on the predictive ability of core inflation measures

To better understand the predictive ability of various measures to core inflation, a simple auto-regressive model will be applied, including past information on the headline inflation, along with past information on core inflation. According to Lafléche (1997),

this simple method may analyse whether a core inflation measure contains additional information that improves the overall inflation forecast.

$$\pi_t^{CPI} = \alpha_0 + \alpha_1 \pi_{t-1}^{CPI} + \alpha_2 \pi_{t-2}^{CPI} + \alpha_3 \pi_{t-1}^{Core}$$

Where, π_t^{CPI} is the overall annual inflation and π_{t-i}^{core} is the annual rate of various measures to core inflation for the period *t-1*.

Table 7 shows the results according to various core inflation measures

Table 7. Regression results

π^{Core}	α_0	α_1	α_2	α_3	$\bar{R}^2$	S.D
ΔCPI	0.006 (2.4)		0.71 (7.6)		0.51	1.4
Trimm_Inf	0.003 (2.2)	0.96 (17.9)		-0.39 (-3.3)	0.80	0.8
PE_Infl	0.007 (2.3)		0.4 (2.6)	0.4 (3.2)	0.61	1.2
DW_Infl	0.005 (2.4)	0.87 (8.3)	-0.36 (-3.4)	0.41 (3.1)	0.82	0.8
PW_Infl	0.006 (2.4)		0.7 (7.6)	-0.008 (-0.4)	0.51	1.4

Note: Regression coefficients; in parentheses, t-statistic; corrected coefficient ($\bar{R}^2$) and standard deviation (S.D) for each regression.

Judging from $\bar{R}^2$ magnitude, it results that the core inflation measured according to trimmed mean, permanent exclusion, and double weighting-based methods, contains information on future headline inflation trend. Such a thing not only is not verified by core inflation measured according to persistent weights-based method, but above all it results statistically insignificant.

4.2.2 Characteristics of excluded components

In an effort to statistically estimate the ability of various core inflation alternatives to predict the headline inflation movements, the following regression form, proposed and applied by Rich, Steindel (2005)[16], including even past rates of the headline and core inflation, will be used:

$$\pi_{t+h} - \pi_t = \alpha_0 + \alpha_1 \pi_L + \alpha_2 \pi_L^{Core} + ß\,(\pi_t - \pi_t^{Core}) + \varepsilon_t$$

Where, π_{t+h} is the annual rate of the headline inflation for the period $t+h$ *and* π_t^{Core} is the annual rate of various core inflation measures, whereas L is an indicator of different lags, concretely *(1,2,3,4)*. Each regression is estimated for $h=$ 6, 12 and 18.

This simple regression indicates how "the current core inflation deviation" may explain the future headline inflation movements. Testing the null hypothesis H_0: ß=-1 we may verify whether the deviation of the core inflation or the non-underlying component of the headline inflation expressed by the term $(\pi_t - \pi_t^{Core})$, measures accurately the transitory movements of the latter one. If the coefficient ß is higher (smaller) than 1 in absolute value, then it is concluded that the deviation of the core inflation underestimates (overestimates) inflation changes, hence the amplitude of current transient movements. Tables 8-10 depict statistical information respectively for the periods *h=6, 12, 18*. The assessed information indicates that only the trimmed mean-based method may provide a signal about the overall inflation trend for 6 coming months. It is obvious that extending the time horizon until 18 months ahead, it is the other measures (reweighting- and permanent exclusion-based methods) that provide the signal on long-term headline inflation trend.

Table 8-10. Results of regression and null hypothesis

Δ CPI $_{T+6}$	ΔTrimm_ind	ΔPE_ind	ΔDW_ind	ΔPW_ind
$\bar{R}^2$	0.67	0.53	0.41	0.40
ß	-0.85 (-6.9)	-0.31 (-2.3)	-0.52 (-1.9)	-0.6 (-7.5)
P- value* H_0: ß=-1	0.22	0.00	0.09	0.00

Δ CPI $_{T+12}$	ΔTrimm_ind	ΔPE_ind	ΔDW_ind	ΔPW_ind
$\bar{R}^2$	0.80	0.33	0.35	0.60
ß	-1.3 (-11.4)	-0.45 (-2.1)	-0.92 (-3.0)	-0.90 (-10.5)
P- value* H_0: ß=-1	0.00	0.01	0.80	0.24

Δ CPI $_{T+18}$	ΔTrimm_ind	ΔPE_ind	ΔDW_ind	ΔPW_ind
$\bar{R}^2$	0.70	0.52	0.45	0.70
ß	-1.6 (-10.2)	-0.63 (-2.3)	-1.3 (-3.4)	-1.0 (-12.6)
P- value* H_0: ß=-1	0.00	0.17	0.43	0.96

Note: P – value, has resulted after performing the Wald test.
Δ- annual rate

4.2.3 Forecasting headline inflation through individual core inflation components

Until now the core inflation behaviour is analysed as an isolated measure. This section will include other variables, which may contain additional information on future inflation performance. The data are obtained in the form of 12-month changes, or in DLOG form (Variable, 0, 12) and the estimate period is extended from M1:1998 to M12:2007.

Permanent exclusion-based method allows headline inflation forecasting, aggregating the CPI's underlying and non-underlying components. The underlying component (CPI_PE); the unprocessed food component of high seasonality (CPI_UP), the country's fuel prices component (CPI_F) are forecasted by means of models, whereas the administered prices and the excise ones are entered as information of the addition in aggregating the forecasted CPI, taking into account the government's projects in terms of changes in corresponding prices and tariffs.

a) CPI_PE – the underlying consumer price index, according to permanent exclusion-based method[17]:

DLOG(CPI_PE,0,12) = -0.004 - 0.009*DLOG(12_TB yield(-5),0,12) + 0.6*DLOG(CPI_PE (-1),0,12)
(-3.3) (-2.7) (13.1)

-0.09*DLOG(UN(-2),0,12) + 0.1*DLOG(CPI_PE(-5),0,12)
(-6.5) (3.1)

$\bar{R}^2$ = 0.96; S.E.= 0.005; DW= 2.1;

The annual change of the TB 12-month yield, being evidenced for the first time, as a monetary factor that explains core inflation performance, is related negatively to the latter one, with 5 months lag. Until now the M1 has served as a monetary factor used for core inflation forecasting[18]. The M1 role in core inflation forecasting approaches is questionable, under the conditions of structural changes of the banking market over two last years. Along with problems presented by M1, a more important reason that supports the presence of interest rates in core inflation forecasting is related to the fact that monetary policy makes decisions on interest rates and not on monetary aggregates, in order to put inflationary pressures under control. Annual changes of the unemployment rate turn out to be statistically significant.

b) CPI_UP – the unprocessed products index is forecasted more appropriately by an ARIMA (1,1,6) process.

$$DLOG(CPI\_UP,0,12) = \underset{(1.8)}{0.04} + \underset{(10.6)}{0.73} * AR(1) + \underset{(6.3)}{0.56} * MA(6)$$

$\bar{R}^2 = 0.63$; *S.E. = 0.05; DW=1.9*

Such a form allows the forecasting process of this component, taking into account historical movements in prices of high seasonality products.

c) CPI_F – the country's fuel price index:

$$DLOG(CPI\_F,0,12) = 0.02 + \underset{(4.2)}{0.71} * DLOG(CPI\_F(-1),0,12) + \underset{(9.0)}{0.12} * DLOG(Oil\_Abroad(-1),0,12)$$

$$+ \underset{(6.3)}{0.19} * DLOG(lek/usd(-1),0,12) - \underset{(-3.3)}{0.29} * DLOG(CPI\_F(-2),0,12)$$

$\bar{R}^2 = 0.95$; S.E.=0.01; DW= 1.9;

The country's oil prices are positively related to the international oil price performance (Oil_*Abroad*) with one month lag and to the (lek/usd) exchange rate with the same lag.

Finally, weighing the annual change rates of the forecasted

indices of components with their weights, the total annual inflation is obtained[19].

INF_CPI=(INF_CPI_PE*w_PE)+(INF_CPI_UP*w_UP)+(INF_CPI_F*w_F)+(INF_CPI_ADM*w_ADM) +(INF_CPI_EXCISE*w_EXCISE)

Where, w_*PE,* w_*UP,* w_F , w_*ADM* , w_EXCISE are unchangeable weights of the corresponding components index (Table 11) and INF_component is the annual inflation on a monthly basis of the corresponding components.

Table 11 Weights according to components

Components	Weights
w_Core	0.783
w_UP	0.114
w_F	0.016
w_ADM	0.050
w_EXCISE	0.037
Total	1.000

The forecast is made for the period M12:2006 to M12:2007, in order to test the performance of the forecasting model explained above. The estimation of forecasting errors in a 12-month horizon (RMSE), with the core inflation measured as a trimmed mean, resulted about 1.5, whereas with the PE measure (according to ECB approach) it turned out to be 0.5. Sometimes the forecasting overestimates the actual rate and sometimes it underestimates it quite moderately, standing close to actual rate trajectory. The forecasting error series (actual rate deviation from the one predicted for forecasts carried out 12 months ago) has almost a normal distribution with N~(0,1) parameters, suggesting casual deviations and not systematic ones, in one direction or another, which would put into doubt the econometric suitability of the model.

Given that the reweighting method does not allow the calculation of non-underlying component, only core inflation is modelled for these two measures, depending on monetary and real indicators. Concerning core DW inflation, M1 and unemployment rate turn out to be variables and exponents.

DLOG(DW,0,12) = -0.0001 + 0.90*DLOG(DW (-1),0,12) + 0.008*DLOG(M1 (-12),0,12) - 0.036*DLOG(UN(-4),0,12)
(-0.14) (31.5) (1.7) (-4.3)

$\overline{R}^2$= 0.94 and S.E =0.4

Results of core inflation forecasts according to double weighting measure reveal lower rates of this measure than the headline inflation, suggesting the presence of systematic deviations and a positive sign in forecasting. The forecasting results indicate that this core inflation measure does not bring about an added value to the overall inflation forecasting, because it does deviate from the statistical estimating features of forecasts. In the meantime, the core inflation according to PW measure indicates an insignificant statistical relation to the monetary aggregates. The discrepancy of this criterion (relation to monetary aggregates) makes this core inflation measure useless.

5. CONCLUSIONS

Core inflation measurement and forecast constitute important information for the decision-making process of a central bank. The selection of an appropriate measure is a debatable issue, since it is related to the purpose of using the core inflation series. Core inflation measuring approaches and methods are various. The sophisticated methods tend towards more accurate measures, but at the same time they have a low degree of transparency and require a qualitatively better and more complete database. Under the conditions when the meeting of these criteria is difficult in Albania's case, the material reveals new core inflation measures, based on the economic behaviour of CPI components criteria and on statistical distribution of relative price deviation of basket goods and services from their mean.

Based on the rich experience of different central banks in core inflation measures and forecasting, along with existing measures of the core inflation according to trimmed mean approach, the material reveals the results of core inflation measure according

to permanent exclusion-based method, as well as two measures that operate according to the logics of re-weighting the basket items, i.e., not excluding the basket items. Each of the methods is associated with judgement on their advantages and disadvantages. The permanent exclusion-based method is simpler in understanding. It prevents the problem of various weights and what is more important, based on it we can generate forecast for the headline inflation. On the other hand, its problems relate to the exclusion aspect, which permanently neglects a part of basket goods, which frequently contain information on monetary/core inflation.

This problem is not experienced in the category of reweighting methods. Moreover, their positive aspect rests mainly on this point, on non-permanent exclusion of some basket items. On the other hand, these methods are charged with subjective elements, a fact that raises doubts concerning measures carried out by means of them. Another concerning aspect related to them is that inflation forecasting does not go beyond core inflation forecasting. These measures provide forecasts only for the long-term headline inflation trend, through a simple core inflation modelling.

Based on the performed tests, the new core inflation measures (the permanent exclusion-based method and the reweighting one) indicate that the core inflation informs on the headline inflation trend for a period of 18 months ahead. The core inflation measured as a trimmed mean informs better on the short-term overall inflation trend (till 6 coming months). Though the permanent exclusion-based method meets more completely the criteria, it suggests that for analysis purposes, other core inflation categories should be followed.

6. PROPOSALS

- The drawn conclusions indicate that the measure that qualitatively meets the statistical criteria and those of transparency and forecasting, is the one provided according to permanent exclusion-based approach. The main priority

stands in the forecasting process. The underlying component is significantly affected by the developments of interest rate and treasury bills yield of 12-month maturity and by unemployment rate. The modelling of other components provides more complete information about the impact of non-monetary factors on non-underlying parts of the headline inflation, which were not previously taken into account in a structured way. Given the above considerations, it is proposed that the existing set of forecasting models is added with the headline inflation forecasting model from the core inflation according to the permanent exclusion-based method.

- Core inflation generated by the exclusion-based method ensures a transparent and understanding means of communication for the broad public. Reporting it, along with headline inflation and other core inflation measures, aims to inform about monetary inflation components. The publication and analysis of this inflation indicator would help economic agents and the broad public to accurately understand the monetary policy decisions. Therefore, it is proposed to include core inflation reporting and analysis to periodical reports of the Bank of Albania's monetary policy.

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ENDNOTES

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[1] Applying the trimmed mean approach (Çeliku, 2005), currently there are excluded about 30% of the basket items (sub-items): from the CPI basket, by 15% in each side of distribution of deviations.

[2] Two forecasting models (on a monthly and quarterly basis) currently used at the Bank of Albania have been constructed on the concept of core inflation as a trimmed mean.

[3] The Bank of Albania, Round Table "Inflation targeting 2", December 2006

[4] Çeliku, Shtylla, Hashorva, Hoxholli and Kota "Portfolio of inflation forecasting models at the Bank of Albania", Discussion Paper, presented at Round Table "Inflation Targeting 2", December 2006, BoA.

[5] The trimmed mean stands by the middle of methods, and the statistical criteria assume a significant weight in selection (Sivler, 2006).

[6] Econometric methods have not been treated due to low degree of transparency and high requirements they have in terms of database quality.

[7] In the reviewed consumer basket (December 2007), these weights are respectively 23% and 77%, that is, they do not present essential changes.

[8] Moreover, it is transparent, which is a stronger requirement in the case of inflation targeting regime, when the core inflation is targeted.

[9] Until end of 2006.

[10] For simplicity reasons, this core inflation measure will be referred to as PE-Inf in the material.

[11] As it happens in the case of the trimmed mean approach.

[12] In this aspect, this method is similar to the trimmed mean approach.

[13] It is a statistical indicator that serves to make comparisons about volatility.

[14] Root mean square error.

[15] Mean absolute deviation.

[16] Used also in various researches, such as Clark (2001), Hogan, Johnson and Laflèche (2001), Cutler (2001) and Cogley (2002).

[17] According to ECB approach.

[18] As a positive relation to core inflation, at 8 –month lag.

[19] The other components are included on the basis of assumed series for the administrated prices (energy, water) and excise goods prices.

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