ANNEX

Evaluation of the Annual Macroeconomic Forecasts[1]

The internationally recognized best practice in public finance management includes regular evaluation of the macroeconomic forecasts that are used in the fiscal planning. The aim is, first, to assure the transparency and accountability of the public governance and, second, to improve the forecasting based on objective analysis of the predictive model performance. The target of this evaluation is to analyse the accuracy of the Ministry's of Finance annual macroeconomic forecasts in order to improve the medium term fiscal policy planning. The evaluation starts with the outline of results, followed by methodological explanations of forecast error calculations.

RESULTS

Since 2013, one to four-year ahead GDP growth rate forecasts have been higher than actual outturns, while the current year GDP growth has been slightly underestimated. Looking at the trends of the GDP growth rate forecast errors, the time horizon can be divided in four periods. From 2004 to 2009, the GDP growth rate forecasts were lower the actual outturns. Since 2010, the trend changed to the opposite – the actual GDP decrease was larger than expected. During the economic recovery, the forecasts were below the actual outturns again, but since 2013, the one to four-year ahead forecasts have been too optimistic. These trends apply to both nominal and real GDP growth rates (see Charts 1 and 2 below).

Since 2013, annual current year inflation forecasts have been close to zero percent, and one to four-year ahead forecasts have been expected to exceed the 2% threshold, but the inflation target has not been reached yet. Until 2008, the expected inflation was lower than the actual outturns, e.g., from 2004 to 2006, the one to four-year ahead inflation forecasts were below 6%, but the inflation rate in fact exceeded 10% in 2007 and 15% in 2008. Since 2013, the one to four-year ahead inflation forecasts have been above the inflation target of 2%, but the target has not been reached yet, and the inflation rate has stabilized below 1% (see Chart 4).

Forecast errors 2004-2016	Current year forecast (T)			One-year ahead forecast (T+1)			Two-year ahead forecast (T+2)			Three-year ahead forecast (T+3)		
	ME	MAE	RMSE	ME	MAE	RMSE	ME	MAE	RMSE	ME	MAE	RMSE
Nominal GDP growth	1,18	2,06	2,82	0,28	7,57	10,62	-1,45	9,48	13,08	-3,49	7,73	12,33
Real GDP growth	0,12	1,18	1,93	-1,36	4,48	7,14	-2,96	5,51	8,95	-4,37	5,55	9,32
GDP deflator	1,01	1,08	1,37	1,55	4,10	5,01	1,45	5,28	6,36	0,90	4,42	6,08
Inflation (PCI)	-0,02	0,30	0,48	0,78	3,15	3,90	1,17	4,14	5,25	0,95	3,51	5,06

Table 1. Error estimates for macroeconomic indicators forecasted by MoF (Council's calculations)

Neither the regular revision of actual data by the Central Statistical Bureau nor the transition to the new European System of National and Regional Accounts have changed the overall trends of forecast errors. Because of the revision of the actual data, large difference between the first actual outturn and data as of today (according to ESA 95) is observed in 2007 - nominal GDP growth rate

[1] Annex is prepared in cooperation with Ernst & Young Baltic Ltd. according to the agreement on macroeconomic consultation services, available online (in Latvian):
http://fdp.gov.lv/files/uploaded/FDP_1_15_1427_20170915_FDP2017_3_Ligums_makro.pdf

increased by 7,4 percentage points and GDP deflator increased by 7 percentage points. In 2013/2014, the European System of National and Regional Accounts was changed from ESA 95 to ESA 2010, the largest difference has appeared for the real GDP growth rate and GDP deflator in 2009 – the indicators changed by 3,3 percentage point increase and 8,4 percentage point decrease respectively.

Real GDP growth rate forecast errors	Mean error			Mean absolute error			Root mean squared error		
	Current Year	One-year Ahead	Two-year Ahead	Current Year	One-year Ahead	Two-year Ahead	Current Year	One-year Ahead	Two-year Ahead
MoF (budget)	0,123	-1,358	-2,964	1,185	4,475	5,509	1,934	7,143	8,947
EC (spring)	0,262	-1,533	N/A	2,646	4,683	N/A	3,401	7,344	N/A
EC (autumn)	0,115	-0,950	-2,645	0,731	3,967	5,027	1,204	6,006	8,541

Table 2. Comparison of error estimates for real GDP forecasts by EC and MoF

Further, data visualisation is used to analyse the relevance of the data updates, it includes the first actual outturns, as well as data as of today (January 17, 2018) according to both ESA95[2] and ESA2010[3].

First actual outturn (taken from the attachment to the State budget)	Data as of today according to ESA 2010	Data as of today according to ESA 95	Annual macroeconomic forecasts by MoF

Table 3. Curve designations in graphs below

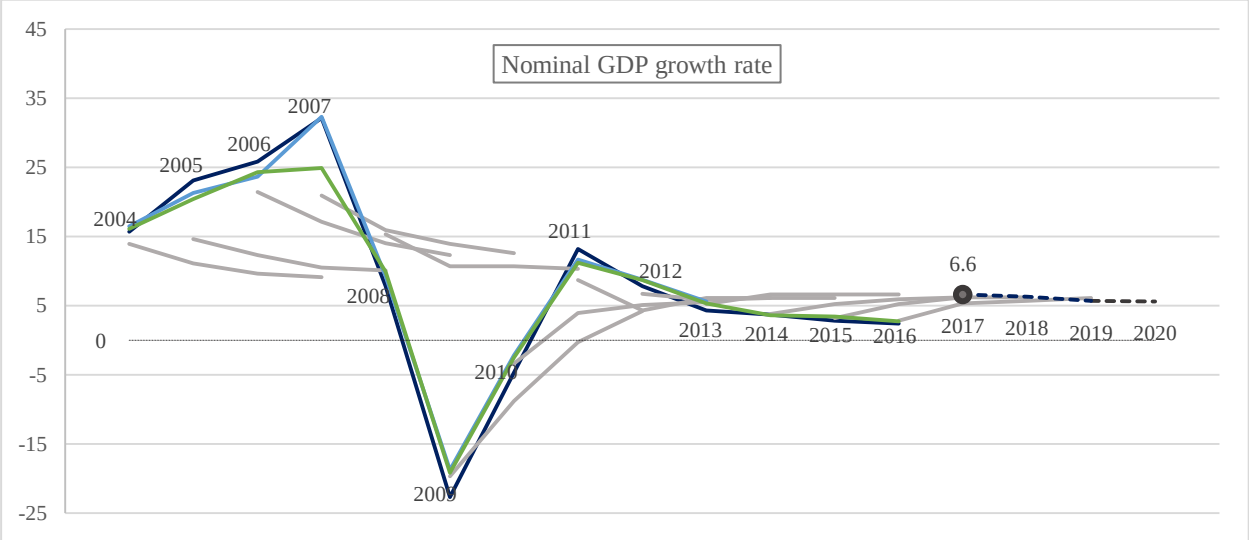

Chart 1 Nominal GDP growth rate, % - annual forecasts by MoF and actual outturns

[2] European system of national and regional accounts fully implemented in 1998, available online: *http://ec.europa.eu/eurostat/statistics-explained/index.php/Glossary:European_system_of_national_and_regional_accounts_(ESA95)*

[3] European system of national and regional accounts fully implemented in 2014, available online: *http://ec.europa.eu/eurostat/statistics-explained/index.php/Glossary:European_system_of_national_and_regional_accounts_(ESA_2010)*

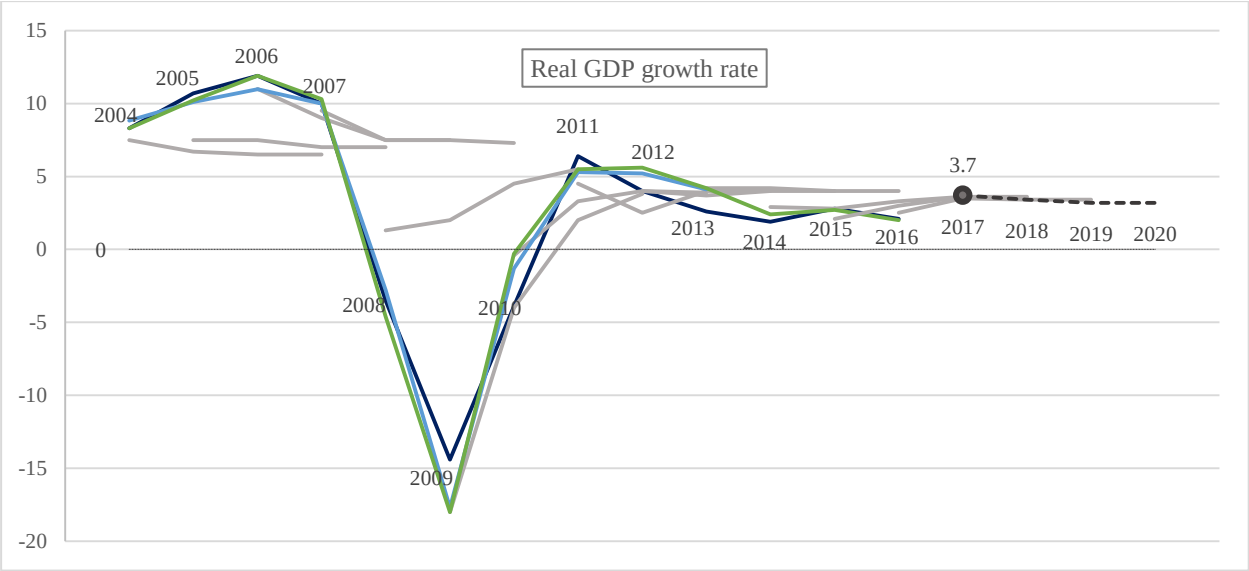

Chart 2 Real GDP growth rate, % - annual forecasts by MoF and actual outturns

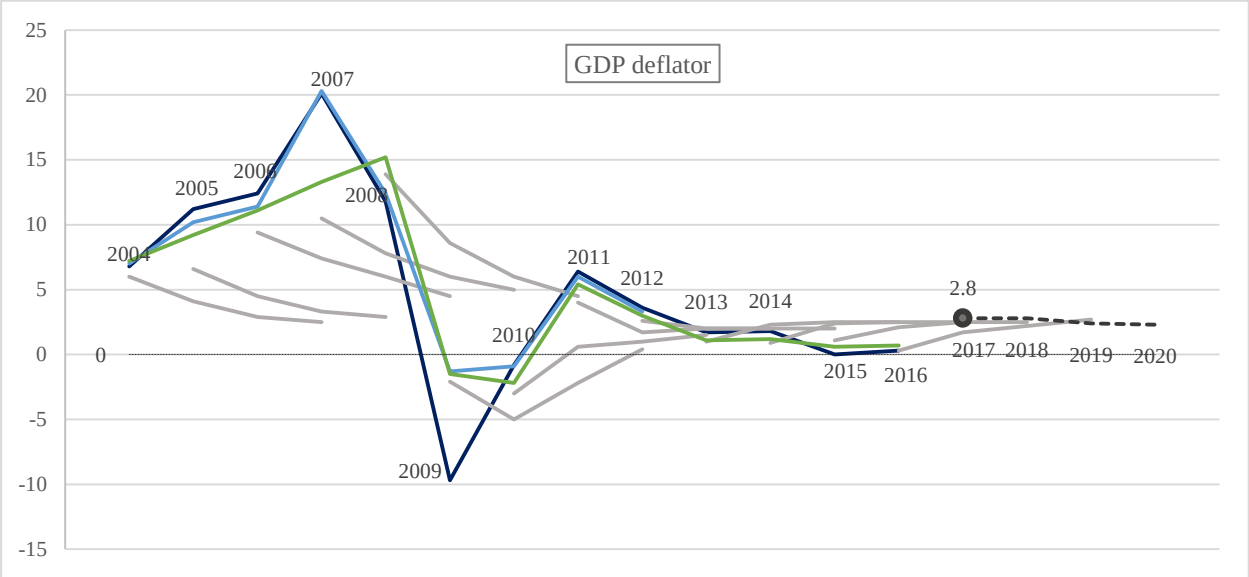

Chart 3 GDP deflator, % - annual forecasts by MoF and actual outturns

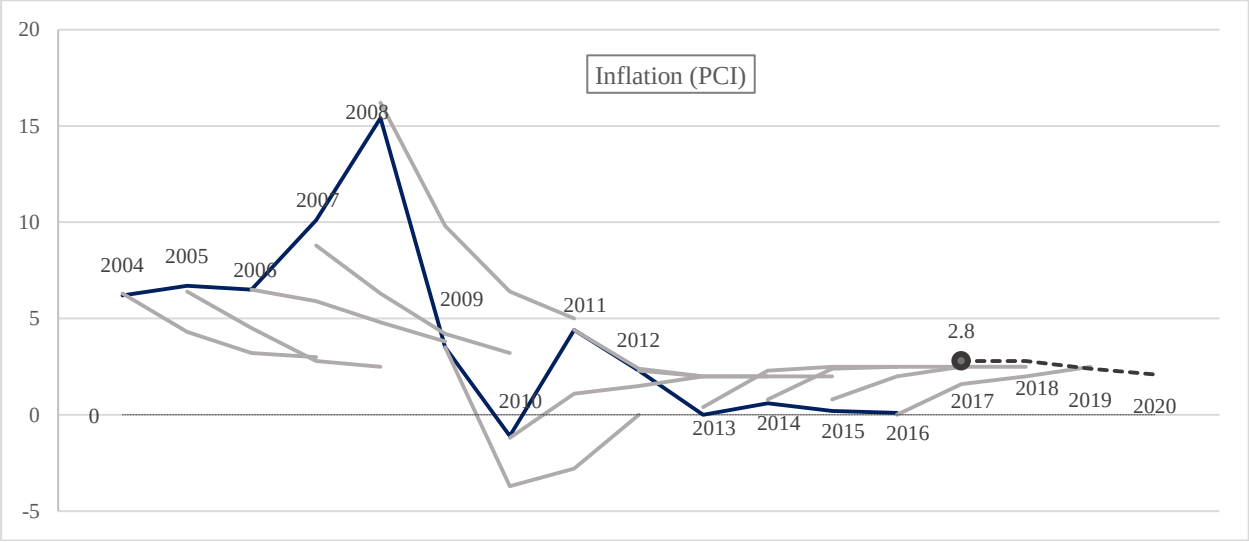

Chart 4 Inflation (PCI), % - annual forecasts by MoF and actual outturns (do not change in time)

Ministry of Finance (MoF) has a well-developed macroeconomic forecasting methodology, but it implies similar patterns of forecast errors as European Commission (EC). MoF and EC have overestimated the real GDP growth rate in short term - both one-year and two-year ahead forecasts on average have been too optimistic (see negative ME in table 2). According to the findings by European Commission Directorate-General for Economic and Financial Affairs[4] it is not only the EC but also OECD and IMF researchers too, who "practically never forecast a negative growth rate in the second year of their short term forecasts".

This evaluation is prepared for the further use within the analysis of the fiscal policy planning. Real time macroeconomic data are vital in the understanding the economic cycle. However, for implementing the counter-cyclical fiscal policy the expectations of the macroeconomic data in the medium-term are as important as the actual outturns. This evaluation has analysed the accuracy of the macroeconomic forecasts by the Ministry of Finance since 2004. To conclude, whether the government has followed the counter-cyclical fiscal policy rules the further analysis should look at:

- The annually planned fiscal deficit (according to the medium-term State budget) and the actual State deficit data against the forecasted and actual macroeconomic indicators, to see, if the yearly deficit level tends to be counter-cyclical.
- Second, an evaluation of the State revenue and expenditure forecasts has to be carried out.

METHODOLOGY

An annual forecast of macroeconomic indicators plays an important role in the medium-term fiscal policy planning. Since 2016, Fiscal Discipline Council is responsible for the approval of the annual macroeconomic forecasts that are initially developed by Ministry of Finance. The macroeconomic forecast includes five indicators (nominal GDP growth, real GDP growth, GDP deflator, inflation (consumer price index) and potential GDP growth[5]), and is used in the further calculations within the Stability and Growth Pact[6] and the medium term State budget. Therefore, the accuracy of the macroeconomic forecast has an influence on the fiscal policy planning, specifically on the counter-cyclical fiscal policy implementation.

This evaluation of the annual macroeconomic forecasts analyses the data since 2004, and it has two parts: first, forecasting accuracy is examined by calculating forecast errors and using data visualisation, second, the annual forecast of the real GDP growth rate by Ministry of Finance is compared with the forecast by European Commission. The data sources are the attachment *Main Macroeconomic Indicators* to the annual State budget (MoF forecast) and EC's annual spring and autumn forecast reports.

The following error estimates are used to measure the accuracy of the macroeconomic forecasts.

1. Mean Error (ME)

It is the average error of difference between the actual (y_j) and forecasted ($\hat{y}_j$) values.

$$ME = \frac{1}{n}\sum_{j=1}^{n}\left(y_j - \hat{y}_j\right)$$

2. Mean Absolute Error (MAE)

It is the average error of absolute difference between the actual (y_j) and forecasted ($\hat{y}_j$) values.

[4] EC (2017) *Evaluating Medium Term Forecasting Methods and their Implications for EU Output Gap Calculations* Discussion Paper 070, ISSN: 2443-8022, available online: *https://ec.europa.eu/info/sites/info/files/dp070_en.pdf*

[5] Potential GDP growth rate is a model-based estimate and, therefore, is not included in this evaluation.

[6] Assessment of Latvia's convergence programme according to Stability and Growth Pact, available online: *https://ec.europa.eu/info/business-economy-euro/economic-performance-and-forecasts/economic-performance-country/latvia/fiscal-surveillance-latvia_en*

$$MAE = \frac{1}{n}\sum_{j=1}^{n}|y_j - \hat{y}_j|$$

3. Root Mean Squared Error (RMSE)

It is the sample standard deviation of the difference between actual (y_j) and forecasted ($\hat{y}_j$) values.

$$RMSE = \sqrt{\frac{1}{n}\sum_{j=1}^{n}(y_j - \hat{y}_j)^2}$$

MoF and EC use different forecast horizons, they vary from one-year ahead up to three-year ahead forecasts. EC has a forecasting horizon of two-years in spring and three-years in autumn both starting with the current year, while the annual macroeconomic forecast by MoF has the longest forecasting horizon of four-years starting with the current year.

In the fiscal planning the most recent data at the time are used, nevertheless the fact that actual data are regularly revised by the Central Bureau of Statistics. Therefore, forecast errors are calculated using the first actual outturns, which are published one year after the forecasted year and are used in the fiscal policy planning. The consequent report by the same author is used (see tables below).

CURRENT YEAR	Year, when forecast is published			One year after			Two years after	Three years after
Forecast error	*Forecast for Year T*			*Actual Outturns*			-	-
	April	June	October	April	June	October		
EC (spring)	X			X			-	-
EC (autumn)			X			X		
MoF (budget)		X			X			

Table 4. The data used for calculating the current year forecast error

ONE-YEAR AHEAD	Year, when forecast is published			One year after	Two years after			Three years after
Forecast error	*Forecast for Year T+1*			-	*Actual Outturns*			-
	April	June	October		April	June	October	
EC (spring)	X			-	X			-
EC (autumn)			X				X	
MoF (budget)		X				X		

Table 5. The data used for calculating the year-ahead forecast error

TWO-YEAR AHEAD	Year, when forecast is published			One year after	Two years after	Three years after		
Forecast error	*Forecast for Year T+2*			-	-	*Actual Outturns*		
	April	June	October			April	June	October
EC (spring)	N/A			-	-	-		
EC (autumn)			X					X
MoF (budget)		X					X	

Table 6. The data used for calculating the two-year ahead forecast error