

## Summary of the Assessment of the accuracy of forecast of macroeconomic and budgetary data May 2023

The assessment of the accuracy of macroeconomic forecasts revealed the following:

- The mean error (ME) of the forecasts for the **real growth rate** over the period from 1996 to 2021 is close to zero and the Wilcoxon statistical test does not indicate a statistical bias. As for the mean absolute error (MAE), it gradually decreases for forecasts established closer to their target year.
- Statistical tests, however, indicate significant upward revisions of real GDP forecasts observed in year “t+1” for in year “t” in autumn “t+3” and in autumn “t+4”.
- The **employment growth rate** forecasts are significantly biased over the period from 1996 to 2021. Indeed, statistical tests indicate an underestimation of employment growth (between +0.02 percentage point for the spring “t+1” forecasts and +0.9 percentage point for the autumn “t-1” forecasts).
- The assessment of the **unemployment rate** forecasts revealed a slightly overestimation (the EM ranging between -0.09% and -0.01%) but a rather good accuracy over the period from 1996 to 2021 (the MAE ranging from 0.52 percentage point in spring “t-1” forecasts to 0.02 percentage point in spring “t+1” forecasts). It should be noted that the overestimation of the unemployment rate is statistically significant only for the forecasts established in autumn “t” and in spring “t+1”.
- The assessment does not reveal a major bias affecting the forecasts of the **consumer price index** (CPI) over the period from 2006 to 2021.
- The forecasts of the **GDP deflator** established in spring “t” are statistically significantly underestimated. The CNFP notes relatively high MAE of the GDP deflator forecasts, even for the forecasts that are close to the observations.
- Regarding the analysis of the performance of the STATEC forecasts in comparison with the EC forecasts, STATEC forecasts of the real growth rate and the employment growth rate show a similar performance to the forecasts published by the EC. On the other hand, the forecasts established by the STATEC concerning the unemployment rate and the GDP deflator growth rate were generally more precise. Indeed, the MAEs of the unemployment rate forecasts and the GDP deflator growth rate forecasts established by the STATEC are respectively 0.3 and 0.5 percentage point lower than the MAE of the forecasts established by the EC. Moreover, the CNFP observes that the MAE of Luxembourg’s GDP deflator forecasts is on average 1.5 percentage point higher than that of neighboring countries (Belgium, France and Germany) while the precision of the forecasts of the other variables analyzed is similar in international comparison.
- The update of the assessment of the accuracy of macroeconomic forecasts confirms the results obtained in the assessment produced in June 2018.

The assessment of the accuracy of budgetary forecasts revealed the following:

- As already noted during the assessment of the accuracy of budgetary forecasts in June 2018, the nominal budgetary balances observed in autumn “t+1” are significantly higher than the estimates put forward previously. Indeed, over the period from 2007 to 2021, the nominal budget balance of the central administration is underestimated on an annual average by around 500 million euros in autumn “t-1” and in autumn “t”.
- Statistical tests indicate a statistically significant underestimation of the nominal budget balance, which can be explained by a(n):
  - Considerable underestimation of revenues in autumn “t-1” (488 million euros on average) which improves slightly in autumn “t” (208 million euros on average). The underestimation, which is statistically significant, is linked in particular to an underestimation of all the revenue sub-categories and, in particular, to the sub-categories Current taxes on income, wealth, etc., Taxes on production and imports and Payments for other non-market output. While the underestimation of Current taxes in income, wealth, etc. and Taxes on production and imports is not significant over the period from 2007 to 2021, it is if we exclude the year 2020 marked by the start of the health crisis.
  - Overestimation of expenses, particularly linked to the overestimation of the direct and indirect investment sub-category. The overestimation of expenditures is less in autumn “t-1” (12 million euros on average) than in autumn “t” (289 million euros on average), since the overestimation is counterbalanced by underestimations of several sub-categories of expenditures (Social benefits, Intermediate consumption, Compensation of employees) more important in autumn “t-1” than in autumn “t”. As a result, only the overestimation of expenditure in autumn “t” is statistically significant, while the CNFP should note that the overestimation of direct and indirect investment is statistically significant in autumn “t-1” and in autumn “t”.
- The nominal balances of the central government in autumn “t+1” were revised upwards in the following years, by an average of 126 million euros if considering the current historical evolution of the nominal government balance published in October 2022. The upward revision consists of an upward revision of revenues amounting to 392 million euros, which is partially offset by an upward revision of expenditures amounting to 267 million euros. The overestimation of expenditures observed therefore becomes less significant or even becomes an underestimation.

The tables below show the average errors (i.e. the difference between observations and forecasts over a defined time horizon “t”) of the macroeconomic and fiscal forecasts analyzed in this assessment. A negative sign indicates an overestimation and a positive sign an underestimation of the forecasts made in years “t-1” and “t” for the year “t” compared to the observation made in year “t+1”. Forecasts that are underestimated or overestimated in a statistically significant manner (according to the Wilcoxon signed rank test) are marked in gray.

**Table 1 – Summary of average macroeconomic forecast errors**

Macroeconomic forecasts (%)	Spring t-1	Autumn t-1	Spring t	Autumn t	Spring t+1
Real growth rate (t = 1996-2021)	-1,0	-0,2	+0,1	+0,2	-0,2
Employment growth rate (t = 1996-2021)	+0,7	+0,9	+0,6	+0,3	+0,02
Unemployment rate (t = 1996-2021)	-0,01	-0,09	-0,03	-0,04	-0,01
Rate of change in IPCN (t = 2006-2021)	-0,08	+0,06	0,00	-0,01	/*
Rate of change in GDP deflator (t = 2006-2021)	+0,7**	+1,0	+1,4	+0,9	+0,1

\*Forecast errors for spring « t+1 » are not shown, as spring « t+1 » pre-observations and autumn « t+1 » observations match exactly.

\*\*Spring « t-1 » forecasts are not available for the years 2006 to 2010.

**Table 2 – Summary of average budgetary forecast errors**

Budgetary forecasts (in millions of euros)	Autumn t-1	Autumn t
Central government nominal balance (t = 2007-2021)	500	497
Central government revenue (t = 2007-2021)	488	208
Central government expenditure (t = 2007-2021)	-12	-289

Source : CNFP Calculations.

The CNFP finds that macroeconomic forecasts are generally reliable over the period from 1996 to 2021, with the exception of the employment growth rate, which underestimated in a statistically significant manner over the entire period. It should be noted that the underestimation of the latter reaches almost a percentage point if we consider the forecasts established in autumn “t-1”, a considerable deviation from the average employment growth rate of 3.2% over the 1996 to 2021 (arithmetic mean).

In addition, the analysis revealed that Luxembourg’s real GDP growth was revised upwards in a statistically significant manner in autumn “t+3” and autumn “t+4” by an average of 0.5 respectively 0.7 percentage points.

Regarding budgetary forecasts, over the period from 2007 to 2021, the CNFP notes a significant underestimation of the nominal central government balance by 500 million euros on average in autumn “t-1” and autumn “t” compared to the observations made in autumn “t+1” for the year “t” (or approximately 625 million euros considering revisions carried out until October 2022). A more in-depth analysis also revealed that the underestimation of the nominal balance results, on the one hand, and for the bigger part, from an underestimation of revenues (488 million euros in autumn “t-1” and 208 million euros in autumn “t”), in particular of the sub-categories Current taxes on income, wealth etc. and Taxes on production and imports, and, on the other hand, from an overestimation of expenditures (12 million euros in autumn “t-1” and 289 million euros in autumn “t”), mainly linked to the direct and indirect investment sub-category.

Article 8bis of the law of July 12, 2014 stipulates that the “STATEC shall take necessary measures and make them public” in the event that the assessment of forecasts “uncovered a significant distortion affecting macroeconomic forecasts over a period of at least four consecutive years”. As this is the case for the forecasts for the employment growth rate, the CNFP calls on the STATEC to provide explanations regarding this circumstance. In the context of Article 8 paragraph b of the Law of July 12, 2014, the CNFP calls on the competent budgetary authorities to react and, where appropriate, to provide explanations regarding the distortions raised in budgetary forecasts.

It is important to specify that the analysis has shown several excessive or exceptional deviations between forecasts (macroeconomic and budgetary) and observations and/or revisions that could result from updated statistical statements and methods, a change in ESA methodology, crisis, political choices or other exogenous factors. Although the CNFP is not in a position to assess such deviations (which would require additional information from the competent authorities) in order to present only the ex-ante imprecision of the forecast. The CNFP is nevertheless convinced of the validity of its findings, in particular that the employment growth rate and the nominal balance are systematically underestimated (as demonstrated by the Wilcoxon rank test). Eliminating these excessive or exceptional deviations could, however, result in a more or less significant under- or overestimation of the various macroeconomic and budgetary variables and/or even change their degree of statistical significance.

In addition, the CNFP must point out the interdependence of macroeconomic and budgetary forecasts. To give just a few examples, labour market forecasts have an impact on the accuracy of forecasts for certain categories of expenditures (e.g. social benefits) and certain categories of revenues (e.g. withholding tax on wages and salaries). Similarly, inflation forecasts have an impact on revenue forecasts, notably for the withholding tax on wages and salaries and VAT-type taxes, or on intermediate consumption expenditure. Nevertheless, the CNFP is obliged to note that it has neither the means nor the information required to carry out a more in-depth analysis of these interdependencies.