Box 2. Measures to proxy uncertainty

The outbreak of the COVID-19 pandemic unleashed significantly higher uncertainties than those associated with previous business cycles. Economic agents' decision-making under risk and uncertainty conditions is implicitly reflected in both the dynamics of aggregate macroeconomic variables (e.g. economic growth, inflation rate, unemployment rate) and the economic policies pursued by the authorities.

The concept of uncertainty, frequently used in multifarious fields of activity, is not associated with a directly observable variable, making it difficult to be quantified. In the economic literature, various measures were developed to determine the level of uncertainty, differentiated by the criteria for the primary data source, the horizon for which it is calculated or the time when the information becomes available (real time or *ex post*). A summary of the most frequently used measures proposed to assess risk, uncertainty and volatility, together with their connection to events that triggered high risk, uncertainty and volatility, is presented by Cascaldi-Garcia *et al*. (2020). The estimation of a set of indicators calculated at macroeconomic, financial and economic policy levels shows a significant increase in uncertainty during the global financial crisis in 2008 and at the onset of the COVID-19 pandemic. The magnitude of estimates at various points in time is linked to the primary causes of the reviewed developments (e.g. political instability, financial crisis, pandemic), whereas the differences in uncertainty measures at the same point in time may stem from both data sources and the potentially different manner of calculation of these measures.

In order to assess the uncertainty dynamics for Romania, an uncertainty measure was calculated using as a primary data source the monthly survey conducted by *Consensus Forecast* among representatives of the participating financial, banking and research institutions since May 2007[1]. In this survey, the answers refer to the expected performance of a set of macroeconomic variables for the current year (when the survey is carried out) and for the next one. The uncertainty measure is calculated starting from the standard deviations – hence, a proxy for the divergence of the participating institutions' opinions – of the forecasted values for the following variables: annual GDP dynamics, household consumption, volume of investment in the economy, industrial production, rate of change of consumer prices, and trade and current account balances (in billions of USD)[2].

The analyses exploiting at monthly frequency the divergence of opinions of the participating institutions generally use a procedure to proxy fixed-horizon forecasts from the available fixed-event forecasts. This implies calculating at time *t* the expected value for time *t+12* by weighting the expectations for the current year-end and the next, respectively (for methodological details, see Doven *et al.*,

1 The forecasts made by all entities included in the survey, their averages and standard deviations are featured in the monthly *Eastern European Consensus Forecast*. Between May 2007 and March 2021, the monthly average of respondents was approximately 14. Previously, the poll was conducted every two months.

2 Budget deficit forecasts are only available as from 2010 H2.

2012)[3]. This procedure is preferred, as the independent use of respondents' expectations for the end of the current or following year (i.e. fixed-event forecasts) affects the month-to-month comparability. The ensuing series, with a high correlation coefficient, can be characterised by a common key component highlighted by the principal component analysis, for which the first component explains to a large extent the variability of the data series, thus enabling to summarise the information on their variability. The datasets used are standardised beforehand to obtain comparable values. The aim is therefore to reduce the dimensionality of the dataset without losing sight of the relevant information contained therein.

Chart A sets out the uncertainty measure that is the result of applying this method May 2007 through March 2021 to Romania and the euro area. Moreover, it shows a number of external and domestic events, of an economic or political nature.

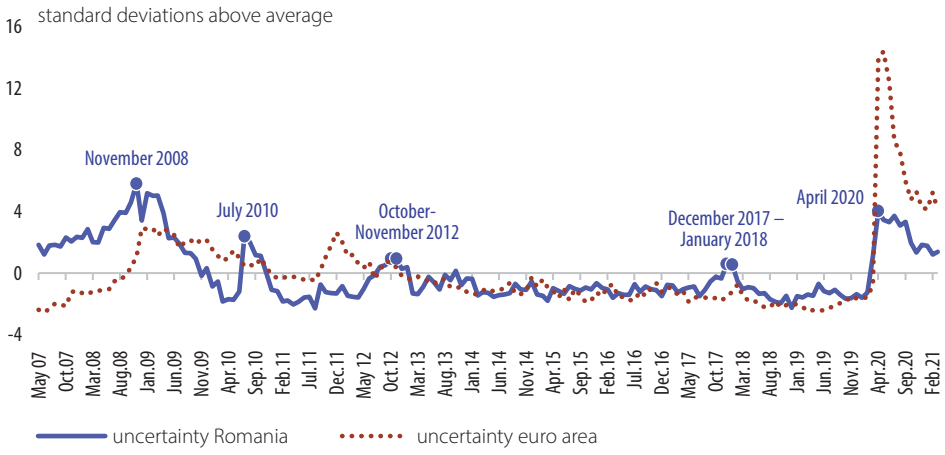

Chart A
A measure to proxy uncertainty using the divergence of analysts' forecasts

Source: Consensus Forecast, Eastern Europe Consensus Forecasts and NBR calculations

In the reported period, the highest level of uncertainty measured for Romania was recorded in November 2008, when estimates indicated approximately six standard deviations above average, preceded by a gradual upturn during that year and followed by low figures subsequently. Against this background, the extraordinary nature of events associated with the global financial crisis can be underscored. The start of fiscal consolidation measures in 2010 was preceded by heightening uncertainty, which in July 2010 was more than two standard deviations above average, then gradually decreased. From 2013 until 2017 H1, generally below-average uncertainty levels were detected.

Against the backdrop of the COVID-19 pandemic outbreak, uncertainty rose abruptly and substantially in the first part of 2020, with a crisis-related peak of more than five standard deviations above average in April. Subsequently, the evolution was largely on the wane, albeit fluctuating. Uncertainty has tended to abate since

[3] For example, uncertainty calculated for April 2021 for the annual inflation rate forecasted for April 2022 is calculated as follows: 8/12 * uncertainty related to the annual inflation rate forecasted for end-2021 plus 4/12 * uncertainty related to the annual inflation rate forecasted for end-2022.

early 2021, as shown by the analysts' responses on how economic activity would fare this year and in 2022, yet the indicator has remained at higher levels than in the pre-pandemic periods.

The link with the similar measure calculated for the euro area (Chart A) is significant, the contemporaneous correlation coefficient peaking at 51.9 percent, i.e. the indicators are coincidental. Uncertainty for the euro area was lower prior to the onset of the global financial crisis and in 2009 H1, but went up once the euro area sovereign debt crisis intensified. Since April 2020, however, uncertainty has been substantially higher than both previous values and that calculated for Romania at that time, reaching more than 14 standard deviations above average in May 2020.

Chart B shows a comparison between the developments in the above-mentioned uncertainty indicator and two alternative risk assessment measures for Romania: the sovereign risk premium proxied by Credit Default Swaps[4] and the systemic risk indicator at financial level CLIFS[5] (Country Level of Financial Stress). According to Cascaldi-Garcia *et al.* (2020), the proxied/estimated risk measures using financial sector variables implicitly react more strongly when crisis triggers originate from within the financial system, unlike exogenous shocks. Furthermore, the economy-specific component also plays a notable part in explaining the relative developments in measures for various countries. These issues also had a bearing on developments in the CDS risk premium, whose growth 2008 through 2009 was significantly higher than the changes induced by the pandemic crisis, when the evolution was substantially more stable. The CLIFS index is also characterised by a high and relatively more persistent volatility in the first part of the reviewed period compared to 2020, when it rose sharply, before returning swiftly to low levels within approximately two months.

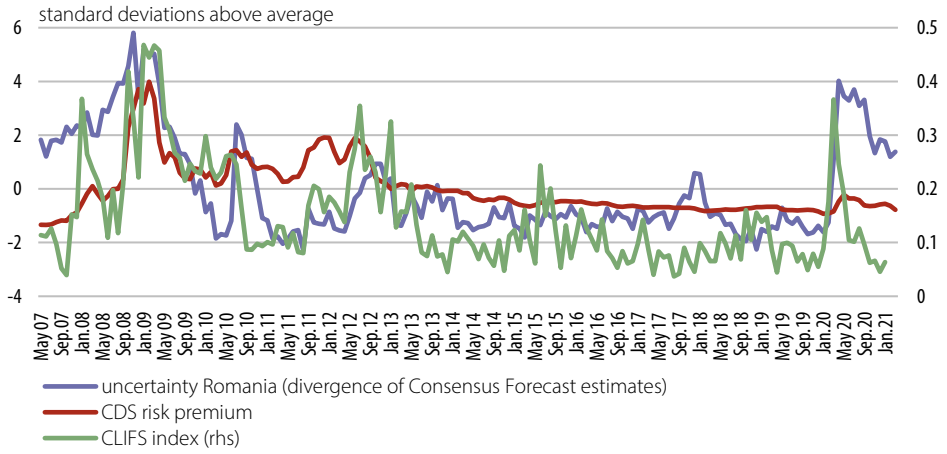

Chart B
Measures to proxy uncertainty and quantify the risk for Romania's economy

Source: Consensus Forecast, Eastern Europe Consensus Forecasts and NBR calculations

4 In order to ensure comparability with the uncertainty measure estimated based on the divergence of analysts' forecasts, the CDS indicator is shown after the data series was standardised.

5 The aggregate index, calculated by the ECB for every EU Member State, is designed as a measure of financial stress, bringing together three major segments of the financial system, i.e. capital market, bond market and foreign exchange market, with values in the range [0,1].

An alternative measure to proxy uncertainty is a quarterly indicator, designed by Ahir *et al*. (2018) for 143 countries, Romania included, as part of the dataset underlying the World Uncertainty Index (WUI) database. At country level, the index is defined using the frequency of the term 'uncertainty' and its derivatives[6] in the *Economist Intelligence Unit*[7] (EIU) reports prepared for every country in the study. The results of the study show a significantly higher level of uncertainty in developing countries, positively correlated to the uncertainty induced by economic policies and the volatility of capital markets and negatively correlated with economic activity growth. Chart C depicts the evolution of this indicator for Romania's economy between 1956 Q1 and 2020 Q4.

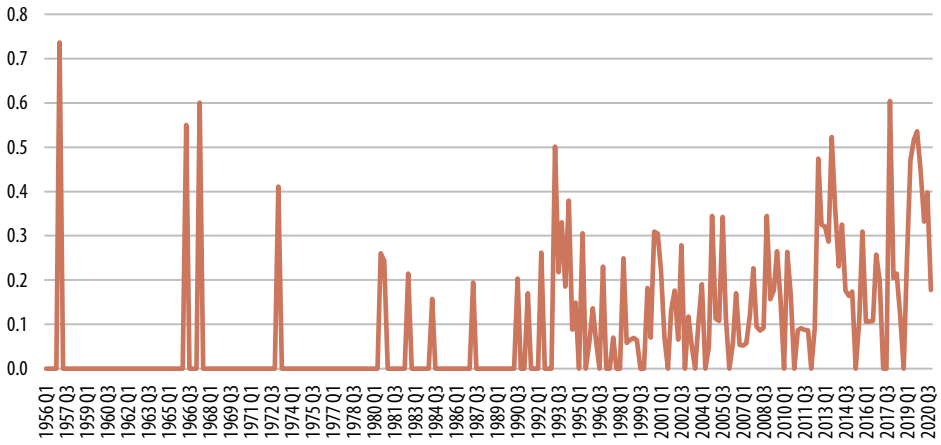

Chart C
A measure from the WUI database to proxy the uncertainty for Romania

Source: https://www.policyuncertainty.com/wui_quarterly.html

The indicator, available for a longer period, reveals some features typical of Romania's economy. The highs seen prior to 1989 could most likely be linked chiefly to domestic events, among which the recession of 1956-1958, the foreign policy turnabout of 1966, as well as the foreign debt crisis in the first half of the 1980s. Moreover, the oil crisis of 1973 could count among the external events that fuelled uncertainty. An elevated level in the final decade of the 20th century, namely in 1993 Q1, could be associated with one of the most aggressive hyperinflation episodes that beset the Romanian economy. Significant values of the indicator were also recorded during the global financial crisis, i.e. 2008 Q4. Subsequently, in the post-crisis period, uncertainty was higher in periods such as 2013 Q3, 2017 Q4 or 2019 Q3 and Q4, owing primarily to domestic political woes.

The current pandemic crisis triggered by the spreading of SARS-Cov-2 was significantly reflected in this index, which saw a reduction in the next period. However, in a counterintuitive manner, the values on record were lower than those reached at the end of the previous year. The explanation could lie with the index building method, which attaches a relatively higher weight to political events, and

6 Terms such as uncertain or uncertainties. Technically, the index is scaled by the number of words contained in each report, their different length both at country level and over time not ensuring data comparability by simply quantifying how frequently 'uncertainty' occurs.

7 The EIU reports assess economic, financial and political trends in the economy by addressing various topics such as: politics, economic policies, domestic economic activity, external and trade payments and their impact on sovereign risk.

thus places the index on an uptrend especially in the run-up to the elections (Ahir *et al.*, 2018).

To sum up, the uncertainty estimated for Romania is fuelled initially by economic, political or financial events, which later take their toll on economic activity. It would be useful that future studies quantify its adverse impact on economic agents' expectations and decisions, but also on economic activity at aggregate level.

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