National Bank of Ukraine

The Financial Cycle Index of Ukraine[1]

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Kyiv, March 20, 2025

[1] This study was conducted with the technical assistance of the Bilateral Assistance and Capacity Building for Central Banks program, financed by Swiss State Secretariat for Economic Affairs, and implemented by the Geneva Graduate Institute. The views expressed in this paper are solely those of the authors and do not necessarily reflect those of the National Bank of Ukraine.

Motivation

- Macroprudential policy aims to ensure financial stability by preventing the accumulation and materialization of systemic risks. It relates closely to reducing the procyclical vulnerabilities of the financial system.
- ***Procyclicality*** refers to the tendency of financial variables to fluctuate around a trend during the economic cycle (Landau, 2009).
- Another meaning of this phenomenon is how banking shocks propagate through the real economy (Andrieș and Sprincean, 2021).
- Vulnerabilities arising from procyclicality are associated with amplifying fluctuations of economic activity via reinforcing interactions between the financial sector and the real economy.
- Our study introduces the ***financial cycle index*** (FCI) as a means to identify the position of the Ukrainian economy in the financial cycle.
- This financial cycle measure can be used as one of guidelines when making policy decisions on the use of countercyclical prudential instruments to prevent the accumulation of cyclical systemic risks.

Literature

This study contributes to the extensive literature on:

- **Indicators of financial system procyclicality**
  - **Credit**: Reinhart and Rogoff (2009), Schularick and Taylor (2012), Jordà et al. (2013), Plašil et al. (2014), Borio et al. (2001), Huizinga and Laeven (2019)
  - **Asset prices**: Kelly et al. (2011), Schüler et al. (2020), Schüler et al. (2017), Borio and Drehmann (2009), Claessens et al. (2009, 2012), Hiebert et al. (2015), Drehmann et al. (2012), Jordà et al. (2014, 2015)
  - **Credit conditions**: Athanasoglou and Daniilidis (2011), ECB (2009)
- **Financial cycle composite indicators**
  - **Domestic cyclical systemic risk indicator** (d-SRI) for Euro area countries, with Denmark, Sweden, the UK: Lang et al. (2019)
  - **Financial cycle measure** for 11 European countries: Stemmel (2015)
  - **Cyclogram** for Slovakia: Rychtárik (2018)
  - **Composite indicator of systemic stress** (CISS) for Czech Republic: Plašil et al. (2014, 2016)

Methodology – Selection of indicators

1 Private sector debt burden subindex	▪ Corporate/household credit to GDP gap ▪ Credit to private sector to GDP gap ▪ New lending to corporations/households to GDP gap ▪ Debt service ratio gap for households
2 Credit conditions and demand subindex	▪ Interest rate on new loans to corporations/households gap ▪ Average of past and expected change in credit standards to corporations and households (from NBU Bank Lending Survey) ▪ Average of past and expected credit demand indicator for corporations and households (from NBU Bank Lending Survey) ▪ Google Trends indicator
3 Housing market subindex	▪ Real primary house price gap ▪ House price to income gap (primary market) ▪ House price to rent gap (primary market)
4 Real economy subindex	▪ Output gap ▪ Current account balance to GDP

Methodology

- **Data**
  - Quarterly series 2001–2024 sourced from statistics of the National Bank of Ukraine, the State Statistics Service of Ukraine, and real estate agencies.
- **Variable transformation**
  - Several indicators are smoothed using a 4Q moving average method;
  - Some variables are included in an inverted form (interest rates on loans) or with an inverse sign (the ratio of the current account balance to GDP, credit standards);
  - Credit stock variables are adjusted for changes in the exchange rate due to the rather high level of loan dollarization, as well as housing market indicators, since housing prices and rents are generally quoted in US dollars;
  - Most of the indicators included in the index are expressed as deviations from their trends, that is, in terms of gaps.

Methodology

- **Calculation of gaps**
  - To estimate the trend components of the FCI's underlying indicators, we use a HP filter;
  - We apply an **one-sided HP filter**

$$\sum_{s=1}^{t}(y_s-\tau_s)^2+\lambda\sum_{s=2}^{t-1}\left((\tau_{s+1}-\tau_s)-(\tau_s-\tau_{s-1})\right)^2\rightarrow\min$$

    and a **two-sided HP filter**

$$\sum_{s=1}^{T}(y_s-\tau_s)^2+\lambda\sum_{s=2}^{T-1}\left((\tau_{s+1}-\tau_s)-(\tau_s-\tau_{s-1})\right)^2\rightarrow\min$$

    with various **lambdas** (1.600, 25.000, 125.000) to compose indices, so as to see which one more accurately describes the phases of the financial cycle;
  - Additionally, we apply both filters recursively, as suggested by Geršl and Seidler (2012), i.e. each past period using only the observations that were available in that period;
  - The gap is defined as the difference between the observed values and the trend components for variables that are expressed as percentages or ratios.

Methodology

- **Variable standardization**
  - To bring variables to a similar dimension, we applied standardization by subtracting the mean from the current observations and dividing by the standard deviation:

$$I_{i,t}^{N} = \frac{I_{i,t} - \mu(I_i)}{\sigma(I_i)}$$

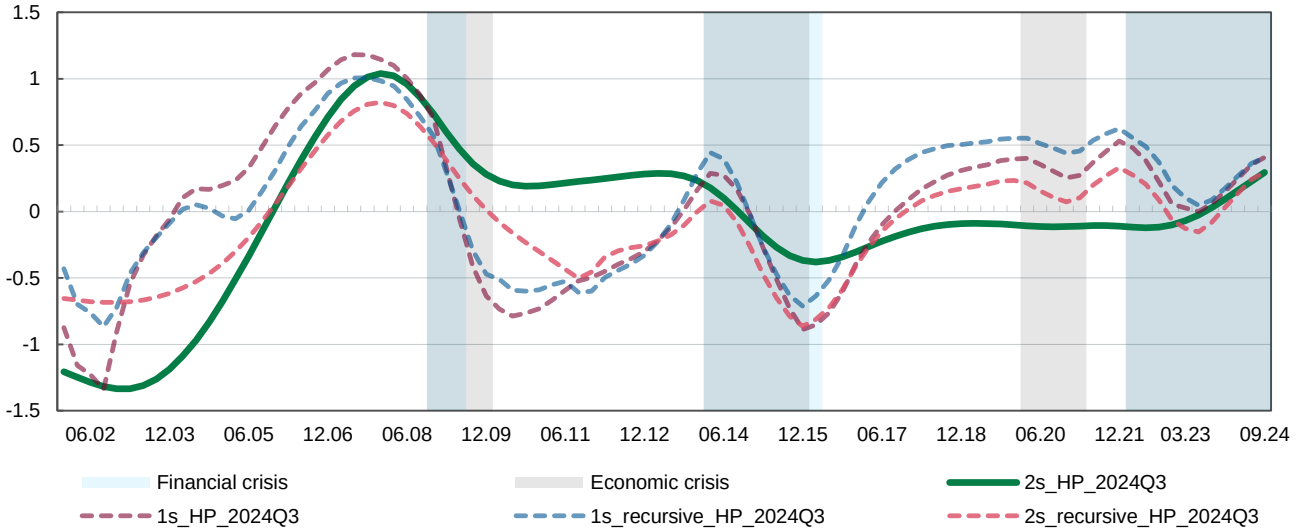
  - As a result, all variables entered into the FCI are roughly between -2 and +2, and centered at zero.

- **Aggregation**
  - The final FCI is set as an arithmetic average of the four subindices, calculated as the arithmetic average of the underlying indicators:

$$FCI_t = \frac{\sum_{j=1}^{4} FCI_{j,t}}{4} \qquad FCI_{j,t} = \frac{\sum_{i=1}^{n_j} I_{i,t}^{N}}{n_j}$$

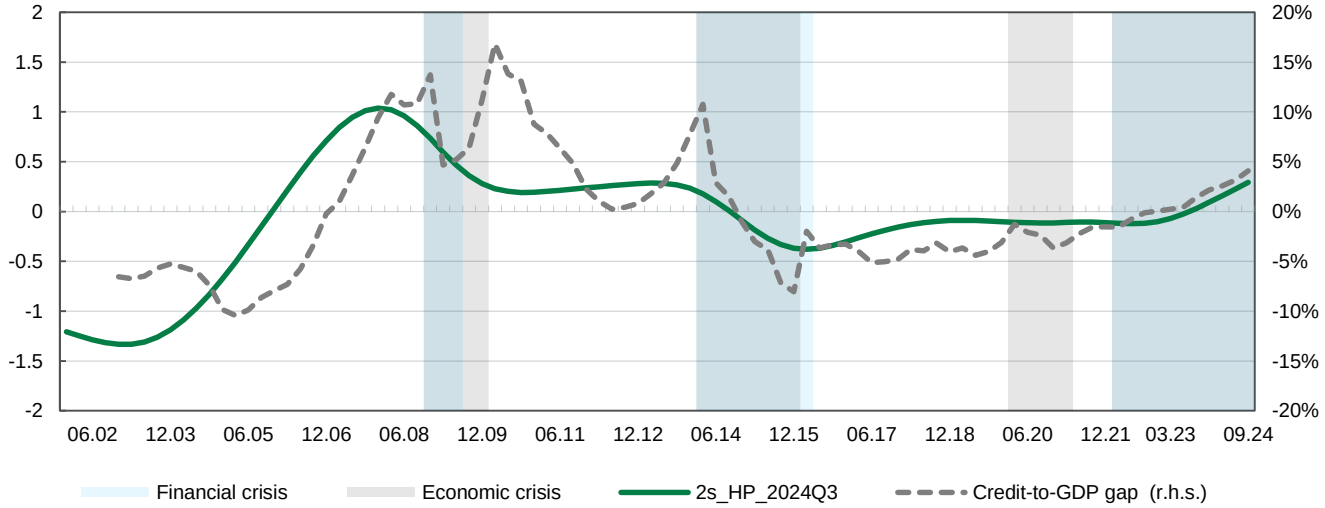
  - Considering the residual volatility of the constructed FCI during the year, the index is smoothed by the HP filter with a lambda parameter of 100, which corresponds to the annual data frequency.

The resulting FCI



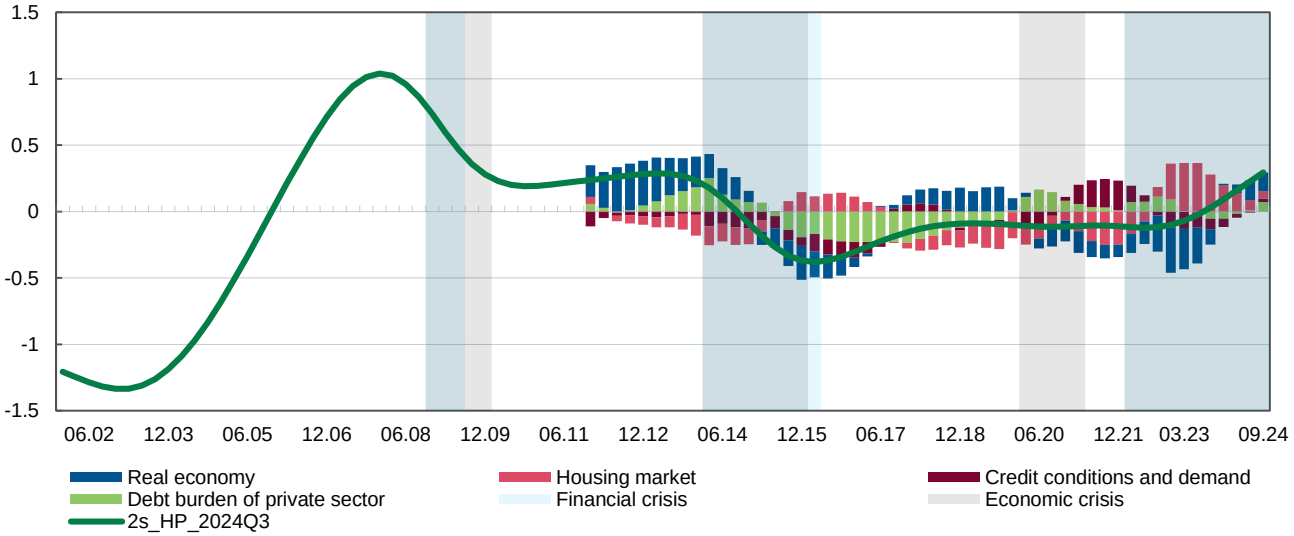
- Analyzing the resulting indices, we conclude that the index estimated by a two-sided HP filter with a smoothing parameter lambda of 25.000 best captures the financial cycle.

The FCI and credit-to-GDP gap



- When comparing the dynamics of the resulting index and the credit-to-GDP gap, we note that the FCI reveals the accumulation of risks earlier and its dynamics is less volatile.

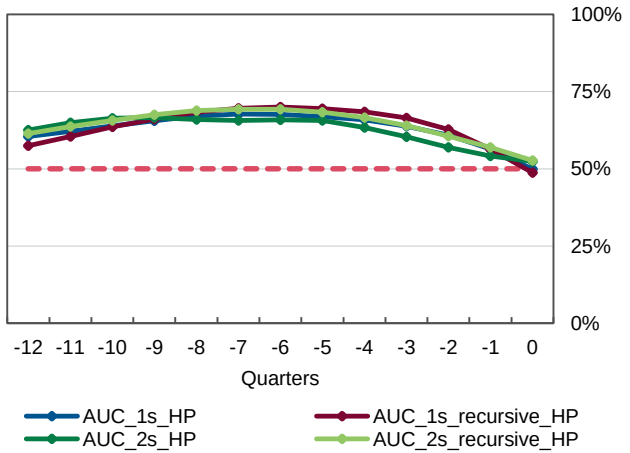
FCI decomposition



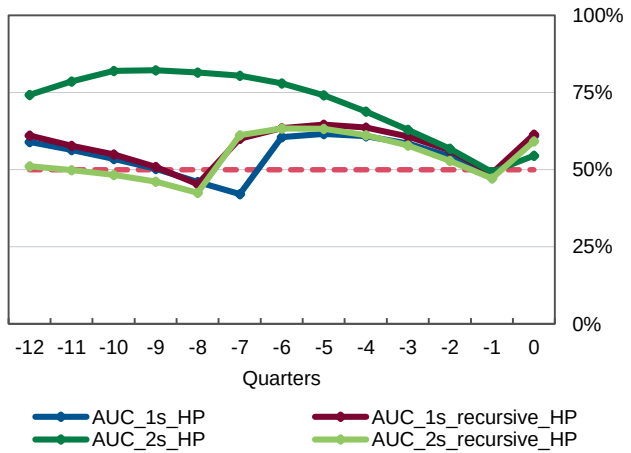
- The contributions are calculated starting from Q4 2011, as all underlying indicators are available only from this period. Before that, the FCI is based on those indicators available in certain quarters.

FCI predictive properties – Assessing the probability of crisis

AUCs for the FCIs estimated with different HP filters on different samples



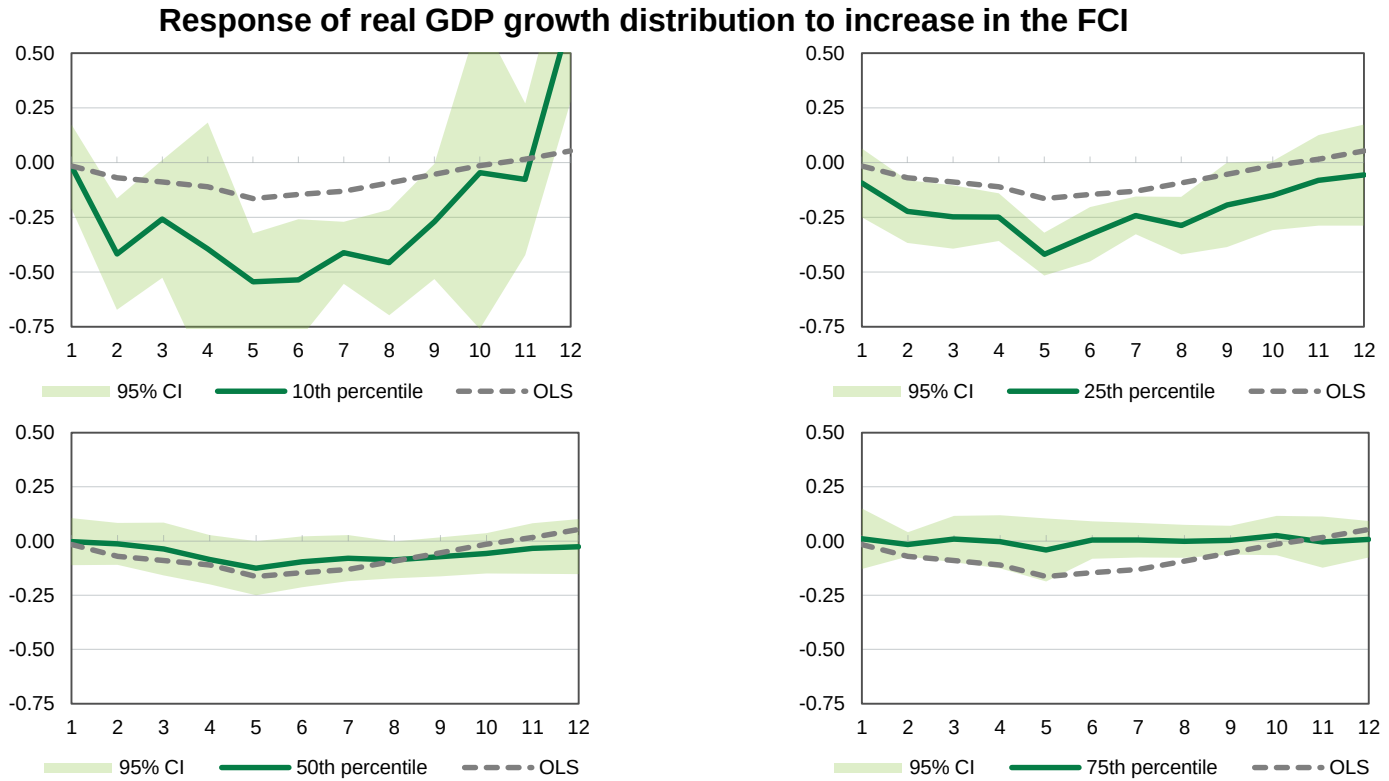
(a) Data sample Q1 2001 to Q3 2024



(b) Data sample Q1 2001 to Q4 2021

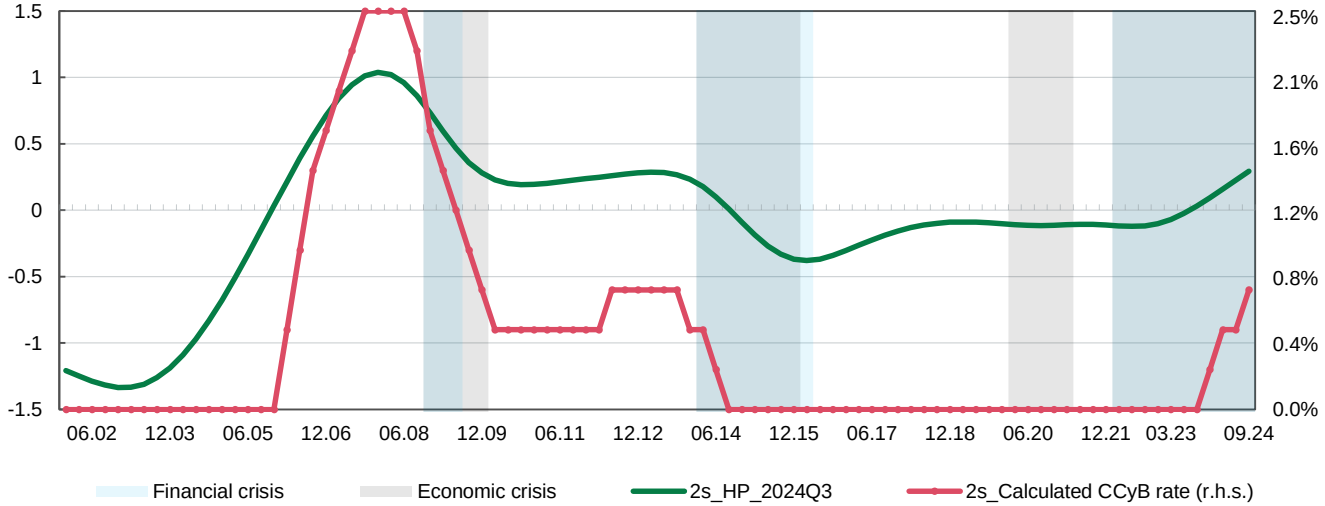
- Following Drehmann and Juselius (2014) and Lang et al. (2019), we analyze the early warning properties of FCIs using the area under the curve (AUC).

FCI predictive properties – Assessing the severity of crisis



Notes: The horizontal axis is the forecast horizon in quarters. The green solid lines indicate the impulse responses of the quarterly seasonally adjusted real GDP growth rate, measured as percentage change from the previous quarter, at the 10th, 25th, 50th and 75th percentiles respectively (in percentage points) to a 0.1 unit increase in the FCI. The gray dashed line shows the response of the average real GDP growth rate, derived from ordinary least squares (OLS) estimates, over the forecast horizon.

The FCI and countercyclical capital buffer



- NBU's approach to the application of the CCyB is in progress. We are going to accept the FCI as one of the guidelines when making a decision on setting the CCyB, but not the only one.
- For example, the formula giving the CCyB rate corresponding to the FCI level can be as follows:

$$CCyB_t = \max\{2.5 \cdot FCI_t, 0\}$$

- The calculated values of the CCyB based on the FCI will only be used as an indicative rate.