Macroeconomic Risk Scoring Methodology

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1 Introduction

Macroeconomic stability is a fundamental prerequisite for sustainable growth and financial resilience. Assessing the level of macroeconomic risk across countries and regions allows policymakers and analysts to identify structural vulnerabilities, anticipate crises, and design appropriate stabilization policies. This methodological framework proposes a quantitative and comparable way to evaluate macroeconomic risk based on three core dimensions—**GDP growth**, **inflation**, and **unemployment**.

The proposed approach integrates both statistical and economic perspectives by combining volatility, deviation from target zones, and exposure to downside shocks. The resulting composite risk score serves as a diagnostic and benchmarking tool for macroeconomic surveillance, cross-country comparison, and stress-testing exercises.

2 Determination of a Macroeconomic Risk Score

The objective of this section is to present the methodology used to measure and compare macroeconomic risk across different groups of countries. This risk reflects the degree of stability or instability in key macroeconomic indicators, particularly **GDP growth**, **inflation**, and **unemployment**.

Macroeconomic stability refers to the capacity of an economy to maintain coherent and predictable trajectories for its fundamental variables. Within this framework:

- steady GDP growth reflects a stable economic trajectory;
- low and non-volatile inflation indicates price stability;
- a relatively stable unemployment rate signals both social and economic resilience.

A high macroeconomic risk level is characterized by strong volatility or persistent imbalances in these indicators. The following methodology can be adopted:

1. **Step 1: Data Preparation**
2. **Step 2: Computation of Country-Level Metrics**
   For each country, the following metrics are computed:
   - **GDP Risk**: risk related to the volatility of GDP growth.
     The higher the instability or the magnitude of negative growth shocks (downside risk), the higher this score.
     $$risk_{gdp} = \sigma_{\text{YoY growth}} + 0.2 \times downside$$
     The term *downside* represents the negative portion of the GDP growth rate distribution, i.e., the sensitivity of an economy to weak or negative growth shocks. Unlike total volatility, which measures variability around the mean without distinction, the *downside* focuses exclusively on deviations below the mean:
     $$downside = \sqrt{\frac{1}{n}\sum_{i=1}^{n} \min(0,\, g_i - \bar{g})^2}$$
     Here, g_i denotes the GDP growth rate for year i, $\bar{g}$ is the average growth rate over the period, and n is the total number of observations. The coefficient 0.2 serves as an adjustment or weighting factor to prevent the downside component from dominating the overall measure.
   - **Inflation Risk**: inflation-related risk based on volatility and deviation from the target zone [2%, 5%].
     The greater the instability or deviation from this range, the higher the risk.
     $$risk_{infl} = \sigma_{\text{inflation}} + 0.7 \times gap_{\text{zone(2,5)}}$$
     The term $gap_{\text{zone(2,5)}}$ measures the average deviation of inflation from the **target price stability zone**, commonly defined between 2% and 5%. In other words, it reflects the extent to which inflation deviates from the range considered optimal for macroeconomic stability.
     $$gap_{\text{zone(2,5)}} = \frac{1}{n}\sum_{i=1}^{n} \begin{cases} 2 - \pi_i, & \text{if } \pi_i < 2 \\ \pi_i - 5, & \text{if } \pi_i > 5 \\ 0, & \text{if } 2 \le \pi_i \le 5 \end{cases}$$
     Here, π_i denotes the observed inflation rate for year i. The range [2%, 5%] corresponds to the stability target, inspired by ECB and other central bank practices. The coefficient 0.7 acts as an **empirical weight**, emphasizing that persistent deviations from the stability zone are a major source of risk—representing approximately 70% of the total inflation risk.
   - **Unemployment Risk**: unemployment-related risk based on volatility and spikes in unemployment.
     The greater the instability or the frequency of extreme increases, the higher the risk.
     $$risk_{unemp} = \sigma_{\text{unemployment}} + 0.3 \times spike^{95\%}$$
     The term $spike^{95\%}$ captures the magnitude of **exceptional unemployment surges**—that is, the distance between the highest values and the normal distribution of unemployment over time. Concretely, it measures **extreme shocks**, computed from the **95$^{\text{th}}$ percentile** of the unemployment distribution:
     $$spike^{95\%} = q_{0.95}(u) - \bar{u}$$

Here, u_i denotes the unemployment rate for year i; $q_{0.95}(u)$ is the 95^{th} percentile of unemployment (the level above which lie the top 5% of observations), and $\bar{u}$ is the mean unemployment rate over the period.

3. **Step 3: Normalization**
   Each metric is normalized on a 0–100 scale using min–max normalization (to avoid dominance of indicators with larger numerical ranges). Thus:
   - 0 corresponds to the best observed stability (least risky country/year);
   - 100 corresponds to the most unstable situation (most risky country/year).

$$x_{\text{norm}} = \frac{x - \min(x)}{\max(x) - \min(x)}$$

4. **Step 4: Construction of the Composite Score**
   A composite macroeconomic risk score is then obtained for each country using the following weights:
   - Inflation: 40%;
   - GDP: 35%;
   - Unemployment: 25%.

   This weighting reflects the differentiated importance of each indicator in overall economic stability. Inflation receives the highest weight (40%) as it directly affects purchasing power, competitiveness, and investor confidence. GDP, weighted at 35%, captures growth capacity and resilience to shocks. Finally, unemployment (25%) serves as a key social and economic indicator, but with a slightly lower weight due to its indirect and lagged relation to the other two dimensions.

5. **Step 5: Aggregation by Group**
   Country scores are aggregated at the group level using the **median**[1] in order to reduce the influence of outliers. Each group is then ranked and categorized into three risk levels (low, medium, high). Several classification techniques can be applied:
   - Percentile-based classification (quartiles, quintiles, deciles);
   - Fixed thresholds based on business rules or regulatory standards;
   - Z-score standardization (mean, standard deviation);
   - K-means clustering (unsupervised grouping by similarity);
   - Gaussian Mixture Models (GMM) for probabilistic clustering;
   - Jenks Natural Breaks (optimal binning for heterogeneous or geographic data), minimizing within-class variance and maximizing between-class variance—commonly used in cartography;
   - Quantile-based approach (constant stress probability) — preferred by the ECB[2];
   - Supervisory stress test scenarios (e.g., Fed's CCAR and DFAST frameworks);
   - Dynamic quantile regression / "Growth-at-Risk" approach: used in many recent studies and by central banks to model downside risks to growth or inflation, focusing on lower quantiles (e.g., 5^{th} or 10^{th} percentiles) rather than conditional means ([**busch2022growt**]).

   This methodology produces two types of outputs:

1. Country-level scores, identifying internal sources of risk;
2. Group-level aggregated scores, useful for regional comparison and strategic analysis.

The proposed approach provides a systematic assessment of macroeconomic stability using simple yet robust indicators. The combination of volatility measures, deviations from comfort zones, and penalties for negative shocks yields a synthetic and comparable measure of macroeconomic risk.

[1] This choice is based on simplicity and robustness. However, for further research, it would be useful to explore alternative aggregation methods such as dynamic weighting, principal component analysis, or Bayesian approaches.

[2] The quantile-based approach maintains a constant probability of stress occurrence over time, regardless of current volatility levels.