Macroeconomic Stage Prediction Dashboard - README

# Overview

This dashboard classifies and forecasts macroeconomic stages (Recession, Slowdown, Recovery, and Expansion) for major economies (USA, China, Japan, Eurozone, South Korea, and Australia). It enables analysts and portfolio managers to identify turning points in economic cycles, evaluate macro conditions, and adjust asset allocation accordingly.  
Built in Python with Dash and Plotly, it allows full interactivity via web UI with robust back-end computations including forecasting, scoring, and feature attribution.

# Key Features (Details in later sections)

* Excel upload for multi-country macroeconomic data (Refer to Bloomberg\_Data\_README)
* Economic stage classification using feature-weighted macro scoring
* Dynamic feature importance viewer and toggler (RF, GB, Ridge, Perm, Logit)
* VAR-based multi-month forecasting with confidence intervals
* Contribution breakdown of each feature to macro score
* 12-month rolling back-testing with accuracy evaluation
* One-click Excel export of data for stage labels, indicators, and weights
* Scenario analysis: baseline, optimistic, pessimistic forecast paths
* Individual indicator breakdown chart across time

# Feature Signs

Positive Contributors (+1): Higher values indicate economic expansion or recovery.

* GDP YoY
* IP YoY
* Industrial Value Added YoY
* Manufacturing PMI
* Yield Spread
* Retail Sales MoM
* Retail Sales YoY
* Exports YoY
* Capacity Utilization
* Services PMI
* Service Production Index
* SmallBiz Sentiment
* Home Sales
* Real Estate Climate Index YoY
* Money Supply M2 YoY
* Money Supply M3 YoY
* Tankan Business Conditions LE Mfg
* Industrial Production YoY
* Consumer Confidence
* Business Confidence All Industry
* Composite PMI
* Credit Impulse
* Retail Expectations
* Economic Sentiment
* Business Sentiment
* Mining Labor YoY
* Business Conditions: 1,
* Business Confidence: 1

Negative Contributors (–1): Higher values indicate economic stress or contraction.

* Unemployment
* Core CPI YoY
* PPI YoY
* Core PCE YoY
* Credit Spread
* SHIBOR 1M
* Household Debt
* Jobless Claims 4WMA
* Housing Loan Interest Rate

# Data Preparation & Pipeline

Data is extracted from Bloomberg using the xbbg Python library and saved as an Excel file (`macro\_data\_bb.xlsx`) with 5 sheets: USA, China, Japan, Eurozone, South Korea, and Australia. The start date of data is January 2018, and countries are changeable using dropdown on dashboard.

Monthly resampling and linear interpolation are used to ensure uniform monthly frequency. Quarterly indicators are filled using a hybrid forward-average approach if latest quarter data unavailable for interpolation. Add derived features, Yield spread from 10Y – 2Y treasury yield and Credit Spread from HY\_OAS for USA.

Backfill current month data with average of past 3 available months’ data if latest month data still not available. For instance, if it is between 25th June 2025 to 20th July 2025 and there is missing data for 30th June 2025, then the backfilling logic will occur.

3 Month rolling average applied all indicators for smoothing purposes to counter volatility.

# Feature Weights Calculation & Display

Used a mixture of statistical models (Random Forest, Gradient Boosting, Ridge Classifier, Logistic Regression, and Permutation Importance) applied on historical data and averaging them to compute feature weights. Allow users to toggle what models to include dynamically. The feature weights for each respective country are displayed as a chart on the dashboard.

# Scoring & Classification Methodology

Each month's economic score is calculated using:

* Robust Z-Score: Normalizes each indicator using median and median adjusted deviation
* Logistical Transformation: Compresses extreme values, maps input to (-1, 1)
* Weighted Aggregation: Each indicator is weighted by its model-derived importance from previous step
* Threshold-Based Classification: Country-specific score thresholds label the month as Recession, Slowdown, Recovery, or Expansion

# Forecasting Method

Forecasting uses Vector Auto Regression (VAR) with past 36 months of indicator data:

* Features are Z-scored standardized and passed to the VAR model
* Forecasts are generated up to 24 months ahead (Can change using slider)
* Forecast scores are blended: 80% forecast + 20% last known actual
* Confidence intervals (Can change using slider among 80%, 90%, 95%, 97.5%, 99%) are computed and visualized
* Each forecast month is scored using the same pipeline as historical data

# Main displays & Interactivity

* Title dynamically changed as user toggles between the countries
* Users can upload excel sheet containing data through the dashboard’s inbuilt button.
* Scorecard showing current and next predicted month is shown. The stage label, raw score, forecast upper bound, forecast lower bound & direction of change is shown. The color-coded legend is below the scorecards.
* Forecast period, Confidence Interval, and Scenario analysis: baseline, optimistic, pessimistic forecast paths. These 3 are in slider/radio buttons format
* The Economic Stage Timeline shows raw score over time; background color coded according to stage labels. Hovering over the chart displays the date, raw score & stage label. Current point & predicted points are highlighted with a blue and red dot respectively. The color-coded legend is below the chart.
* Clicking on economic stage timeline chart dynamically updates the chart showing individual indicator contribution to the raw score for that month.
* Chart displaying individual indicator historical data over time. User can toggle between indicators for that country
* Feature weights chart showing the individual indicator weights calculated using the ML models. User can toggle between models applied using the checkbox and the charts will update dynamically, showing the difference.
* Users can export an Excel file containing:
  + Economic Stage: Dates and stage labels (historical and forecasted)
  + Indicator Data: Monthly data used in scoring
  + Indicator Weights: Feature importance based on selected models

# Back-testing Approach

For the last 12 months, the model has been applied to even earlier data to create predicted stages for these 12 months, comparing them to the actual stage label.

Final back-test outputs

* Monthly comparison of predicted vs actual stage
* Accuracy % displayed above table
* Table containing visual ticks (✔️/❌)

# Requirements & Setup

1. Install required packages via Command Prompt:

Example: {username} will be the name in your phillip email infront of @

Open Command Prompt -> Under “C:\Users\{username}>” -> Type: pip install pandas numpy scikit-learn statsmodels plotly dash openpyxl xlsxwriter

2. Run the Script:

Method 1 (via terminal):

1. Open the terminal or command prompt
2. Enter the path where macro\_dashboard.py is saved in the command line (type “cd Users/Desktop/Macro” assuming your file is saved in the Macro folder in Desktop”
3. Type “python macro\_dashboard.py” in the command line

Method 2 (easier):

1. First Time Running:
   1. Click ‘Properties’ then change ‘Open With’ to ‘Python’ on the macro\_dashboard.py file
   2. If ‘Python’ not found, you need to click ‘Choose an App on your PC’ and find where your ‘python.exe’ file is saved.
2. Subsequently, double clicking and running the macro\_dashboard.py file will work as intended

3. Dashboard will be opened on the browser as a local hosted Dash Web App with link: `http://127.0.0.1:8050/`