Valuation-Metrics Builder
(EOD Historical Data API)

Prepared for the client

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Contents

1 Overview

The Python script `fundamentals_builder_v5.py` retrieves fundamental and technical data for a list of US tickers via the [EOD Historical Data (EODHD)](#) API and produces a `.csv` file. The report documents:

- All API endpoints invoked, with required parameters.

- Mathematical formulas used to compute each output column.

- The logical flow and fall-back rules implemented in code.

2 API Endpoints

2.1 `/real-time`

- **Purpose:** latest price used for the "Current Price" column and as a fall-back for P/E.

- **Template:**

  ```
  https://eodhd.com/api/real-time/{TICKER}?api_token=<API_TOKEN>&fmt=json
  ```

- **Key fields read:** `close`, `price` or `lastPrice`.

2.2 `/eod`

- **Purpose:** historical daily prices (up to 6 years) for highs and yearly closing prices.

- **Template:**

  ```
  https://eodhd.com/api/eod/{TICKER}?
      from=YYYY-MM-DD&to=YYYY-MM-DD&
      adjusted=1&order=d&
      api_token=<API_TOKEN>&fmt=json
  ```

- **Key field read:** `adjusted_close`.

2.3 `/fundamentals`

- **Purpose:** highlights, annual & quarterly earnings.

- **Template:**

  ```
  https://eodhd.com/api/fundamentals/{TICKER}?api_token=<API_TOKEN>&fmt=json
  ```

- **Key sub-nodes:**

  - `Highlights.PERatio`
  - `Highlights.DilutedEpsTTM`
  - `Highlights.EPSEstimateNextYear`
  - `Earnings.Annual` (`epsActual`)
  - `Earnings.History` (`epsActual`, `reportDate`)

2.4 /technical

- **Purpose:** latest MACD and RSI.

- **Templates:**

```
MACD: https://eodhd.com/api/technical/{TICKER}?order=d&
      from={TODAY-2Y}&to={TODAY}&
      function=macd&fast_period=12&slow_period=26&signal_period=9&
      api_token=<API_TOKEN>&fmt=json

RSI : https://eodhd.com/api/technical/{TICKER}?order=d&
      from={TODAY-2Y}&to={TODAY}&
      function=rsi&period=252&
      api_token=<API_TOKEN>&fmt=json
```

- **Rationale for 2-year window:** ensures a full *warm-up period* so the last value is a fully-formed indicator (Section 3).

3 Mathematical Formulas

All prices use *adjusted close.* Let P_t be the most recent price on day t_0.

1. Current P/E

$$\text{P/E}_{\text{current}} = \frac{P_{t_0}}{\text{EPS}_{\text{TTM}}}$$

formula link : https://www.investopedia.com/investing/use-pe-ratio-and-peg-to-tell-stocks-futu
#:~:text=To%20calculate%20the%20P%2FE,%3A%2025%20%3D%20%2475%20%C3%B7%20%243.

2. Average P/E (5 Years)

For each year y in the last five years with available EPS:

$$\text{P/E}_y = \frac{P_{\text{year-end},y}}{\text{EPS}_y}, \qquad \overline{\text{P/E}}_{5y} = \frac{1}{N} \sum_y \text{P/E}_y$$

(N is the count of valid years, $2 \leq N \leq 5$).
N.B: there is no historical p/e in APIs so this is the only way to calculate the average p/e of 5 years

3. Fair Value (Current)

$$\text{FairValue}_{\text{TTM}} = \overline{\text{P/E}}_{5y} \times \text{DilutedEPS}_{\text{TTM}}$$

4. Fair Value (Forecast)

$$\text{FairValue}_{\text{Forecast}} = \overline{\text{P/E}}_{5y} \times \text{EPS}_{\text{Next Year Est.}}$$

5. Fair Value % Change (Gap)

$$\Delta_{\text{FairVal}} = \frac{P_{t_0} - \text{FairValue}_{\text{TTM}}}{\text{FairValue}}$$

6. All-Time-High % Change

$$\Delta_{\text{ATH}} = \frac{P_{t_0} - P_{\text{ATH}}}{P_{\text{ATH}}}$$

7. Recent-High % Change

$$\Delta_{6\text{M}} = \frac{P_{t_0} - P_{\text{High,6M}}}{P_{\text{High,6M}}}$$

8. MACD$(12, 26, 9)$

$$\text{MACD} = \text{EMA}_{12}(P) \; - \; \text{EMA}_{26}(P)$$

Signal line: $\text{EMA}_9(\text{MACD})$. The script stores *only the latest MACD value.* (Full derivation: see Wikipedia.)

9. RSI (1-Year)

Using period $n = 252$ (trading days in ≈ 1 calendar year):

$$\text{RSI}_{252} = 100 - \frac{100}{1 + RS}, \quad RS = \frac{\text{Avg Gain}_{252}}{\text{Avg Loss}_{252}}$$

where averages are Wilder's smoothed moving averages.

MACD Signal (9-period EMA of MACD)[1]

The "signal" line is a smoothed version of the raw MACD:

$$\boxed{\text{Signal}(t) = \text{EMA}_9\big[\text{MACD}(t)\big]}$$

- Uses a 9-period exponential moving average (EMA) of the MACD series.

4 Computation Logic

1. **Pull highlights & earnings.** Try to read `PERatio`. If missing, defer to manual P/E calculation (Step 4).

2. **Download six years of EOD prices** (ensures at least five completed calendar years).

3. **Compute highs:**
    - All-time high (ATH)
    - 6-month rolling high
    - 5-year high

4. **Current P/E:**
    - Use `PERatio` if present.
    - Else: $P_{t_0}/\text{EPS}_{\text{TTM}}$.

5. **Average 5-Year P/E:**
    (a) Build `eps_year` map from annual EPS.

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[1] Investopedia – MACD

    (b) If missing, sum full-year quarterly EPS.

    (c) For each valid year, calculate year-end P/E.

    (d) Return arithmetic mean (needs ≥ 2 years).

6. **Valuations:** Multiply $\overline{P/E}_{5y}$ by TTM EPS and by next-year EPS estimate to get Fair Value (current and forecast).

7. **Technical indicators:**

- Fetch MACD(12,26,9) over a two-year window; use latest record.
- Fetch RSI with `period=252`; use latest record.

8. **Gap metrics:**
$$\Delta_{\text{ATH}}, \ \Delta_{\text{6M}}, \ \Delta_{\text{FairVal}}$$

calculated directly from definitions above.

5 Endpoint Quick-Reference

Purpose	Endpoint (base)
Real-time price	`/real-time/{TICKER}`
End-of-day prices	`/eod/{TICKER}`
Fundamentals + EPS	`/fundamentals/{TICKER}`
MACD	`/technical/{TICKER}?function=macd`
RSI (252)	`/technical/{TICKER}?function=rsi`