# Global Economic Indicators (2010–2025)- World Bank

June 27, 2025

```
[13]: import pandas as pd
      import matplotlib.pyplot as plt
      import seaborn as sns
```

```
[19]: df = pd.read_csv('../data/world_bank_data_2025.csv')
      print(df.head())
      print(df.info())
```

```
  country_name country_id  year  Inflation (CPI %)  GDP (Current USD)  \
0        Aruba         aw  2010           2.078141       2.453597e+09
1        Aruba         aw  2011           4.316297       2.637859e+09
2        Aruba         aw  2012           0.627472       2.615208e+09
3        Aruba         aw  2013          -2.372065       2.727850e+09
4        Aruba         aw  2014           0.421441       2.790850e+09

   GDP per Capita (Current USD)  Unemployment Rate (%)  \
0                  24093.140151                    NaN
1                  25712.384302                    NaN
2                  25119.665545                    NaN
3                  25813.576727                    NaN
4                  26129.839062                    NaN

   Interest Rate (Real, %)  Inflation (GDP Deflator, %)  \
0                11.666131                    -1.223407
1                 4.801974                     4.005674
2                 8.200875                     0.184033
3                10.709709                    -1.995948
4                 3.213869                     3.958897

   GDP Growth (% Annual)  Current Account Balance (% GDP)  \
0              -2.733457                       -18.752537
1               3.369237                        -9.877656
2              -1.040800                         3.473451
3               6.431483                       -11.813206
4              -1.586575                        -4.658577

   Government Expense (% of GDP)  Government Revenue (% of GDP)  \
0                           NaN                           NaN
```

```
1                        NaN                        NaN
2                        NaN                        NaN
3                        NaN                        NaN
4                        NaN                        NaN


   Tax Revenue (% of GDP)  Gross National Income (USD)  Public Debt (% of GDP)
0                     NaN                 2.313385e+09                     NaN
1                     NaN                 2.391841e+09                     NaN
2                     NaN                 2.499118e+09                     NaN
3                     NaN                 2.563517e+09                     NaN
4                     NaN                 2.688102e+09                     NaN
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 3472 entries, 0 to 3471
Data columns (total 16 columns):
 #   Column                        Non-Null Count  Dtype
---  ------                        --------------  -----
 0   country_name                  3472 non-null   object
 1   country_id                    3472 non-null   object
 2   year                          3472 non-null   int64
 3   Inflation (CPI %)             2694 non-null   float64
 4   GDP (Current USD)             2933 non-null   float64
 5   GDP per Capita (Current USD)  2938 non-null   float64
 6   Unemployment Rate (%)         2795 non-null   float64
 7   Interest Rate (Real, %)       1735 non-null   float64
 8   Inflation (GDP Deflator, %)   2904 non-null   float64
 9   GDP Growth (% Annual)         2912 non-null   float64
 10  Current Account Balance (% GDP) 2563 non-null float64
 11  Government Expense (% of GDP) 1820 non-null   float64
 12  Government Revenue (% of GDP) 1829 non-null   float64
 13  Tax Revenue (% of GDP)        1833 non-null   float64
 14  Gross National Income (USD)   2796 non-null   float64
 15  Public Debt (% of GDP)        852 non-null    float64
dtypes: float64(13), int64(1), object(2)
memory usage: 434.1+ KB
None
```

```
[20]:  # Missing values are checked for each column
       print("Missing values:\n", df.isna().sum())
```

```
Missing values:
 country_name                        0
country_id                          0
year                                0
Inflation (CPI %)                 778
GDP (Current USD)                 539
GDP per Capita (Current USD)      534
Unemployment Rate (%)             677
Interest Rate (Real, %)          1737
Inflation (GDP Deflator, %)       568
GDP Growth (% Annual)             560
Current Account Balance (% GDP)   909
Government Expense (% of GDP)    1652
Government Revenue (% of GDP)    1643
Tax Revenue (% of GDP)           1639
Gross National Income (USD)       676
Public Debt (% of GDP)           2620
dtype: int64
```

```
[28]:  # Missing values are handled using forward and backward filling to ensure data␣
       ↪continuity
       df.sort_values(['country_name', 'year'], inplace=True)

       df.ffill(inplace=True)
       df.bfill(inplace=True)
       print("Missing values after cleaning:\n", df.isna().sum())
```

```
Missing values after cleaning:
 country_name                       0
country_id                         0
year                               0
Inflation (CPI %)                  0
GDP (Current USD)                  0
GDP per Capita (Current USD)       0
Unemployment Rate (%)              0
Interest Rate (Real, %)            0
Inflation (GDP Deflator, %)        0
GDP Growth (% Annual)              0
Current Account Balance (% GDP)    0
Government Expense (% of GDP)      0
Government Revenue (% of GDP)      0
Tax Revenue (% of GDP)             0
Gross National Income (USD)        0
Public Debt (% of GDP)             0
dtype: int64
```

```python
[128]: country_to_continent = {
    # Africa
    'Algeria': 'Africa', 'Angola': 'Africa', 'Benin': 'Africa', 'Botswana':
    ↪'Africa', 'Burkina Faso': 'Africa',
    'Burundi': 'Africa', 'Cameroon': 'Africa', 'Cape Verde': 'Africa', 'Central
    ↪African Republic': 'Africa',
    'Chad': 'Africa', 'Comoros': 'Africa', 'Congo': 'Africa', 'Democratic
    ↪Republic of the Congo': 'Africa',
    'Djibouti': 'Africa', 'Egypt': 'Africa', 'Equatorial Guinea': 'Africa',
    ↪'Eritrea': 'Africa', 'Eswatini': 'Africa',
    'Ethiopia': 'Africa', 'Gabon': 'Africa', 'Gambia': 'Africa', 'Ghana':
    ↪'Africa', 'Guinea': 'Africa',
    'Guinea-Bissau': 'Africa', 'Ivory Coast': 'Africa', 'Kenya': 'Africa',
    ↪'Lesotho': 'Africa', 'Liberia': 'Africa',
    'Libya': 'Africa', 'Madagascar': 'Africa', 'Malawi': 'Africa', 'Mali':
    ↪'Africa', 'Mauritania': 'Africa',
    'Mauritius': 'Africa', 'Morocco': 'Africa', 'Mozambique': 'Africa',
    ↪'Namibia': 'Africa', 'Niger': 'Africa',
    'Nigeria': 'Africa', 'Rwanda': 'Africa', 'Sao Tome and Principe': 'Africa',
    ↪'Senegal': 'Africa',
    'Seychelles': 'Africa', 'Sierra Leone': 'Africa', 'Somalia': 'Africa',
    ↪'South Africa': 'Africa',
    'South Sudan': 'Africa', 'Sudan': 'Africa', 'Tanzania': 'Africa', 'Togo':
    ↪'Africa', 'Tunisia': 'Africa',
    'Uganda': 'Africa', 'Zambia': 'Africa', 'Zimbabwe': 'Africa',

    # Asia
    'Afghanistan': 'Asia', 'Armenia': 'Asia', 'Azerbaijan': 'Asia', 'Bahrain':
    ↪'Asia', 'Bangladesh': 'Asia',
    'Bhutan': 'Asia', 'Brunei': 'Asia', 'Cambodia': 'Asia', 'China': 'Asia',
    ↪'Cyprus': 'Asia', 'Georgia': 'Asia',
    'India': 'Asia', 'Indonesia': 'Asia', 'Iran': 'Asia', 'Iraq': 'Asia',
    ↪'Israel': 'Asia', 'Japan': 'Asia',
    'Jordan': 'Asia', 'Kazakhstan': 'Asia', 'Kuwait': 'Asia', 'Kyrgyzstan':
    ↪'Asia', 'Laos': 'Asia', 'Lebanon': 'Asia',
    'Malaysia': 'Asia', 'Maldives': 'Asia', 'Mongolia': 'Asia', 'Myanmar':
    ↪'Asia', 'Nepal': 'Asia', 'North Korea': 'Asia',
    'Oman': 'Asia', 'Pakistan': 'Asia', 'Palestine': 'Asia', 'Philippines':
    ↪'Asia', 'Qatar': 'Asia', 'Russia': 'Asia',
    'Saudi Arabia': 'Asia', 'Singapore': 'Asia', 'South Korea': 'Asia', 'Sri
    ↪Lanka': 'Asia', 'Syria': 'Asia',
    'Tajikistan': 'Asia', 'Thailand': 'Asia', 'Timor-Leste': 'Asia', 'Turkey':
    ↪'Asia', 'Turkmenistan': 'Asia',
    'United Arab Emirates': 'Asia', 'Uzbekistan': 'Asia', 'Vietnam': 'Asia',
    ↪'Yemen': 'Asia',
```

```python
    # Europe
    'Albania': 'Europe', 'Andorra': 'Europe', 'Armenia': 'Europe', 'Austria':␣
↪'Europe', 'Azerbaijan': 'Europe',
    'Belarus': 'Europe', 'Belgium': 'Europe', 'Bosnia and Herzegovina':␣
↪'Europe', 'Bulgaria': 'Europe',
    'Croatia': 'Europe', 'Cyprus': 'Europe', 'Czech Republic': 'Europe',␣
↪'Denmark': 'Europe', 'Estonia': 'Europe',
    'Finland': 'Europe', 'France': 'Europe', 'Georgia': 'Europe', 'Germany':␣
↪'Europe', 'Greece': 'Europe',
    'Hungary': 'Europe', 'Iceland': 'Europe', 'Ireland': 'Europe', 'Italy':␣
↪'Europe', 'Kosovo': 'Europe',
    'Latvia': 'Europe', 'Liechtenstein': 'Europe', 'Lithuania': 'Europe',␣
↪'Luxembourg': 'Europe', 'Malta': 'Europe',
    'Moldova': 'Europe', 'Monaco': 'Europe', 'Montenegro': 'Europe',␣
↪'Netherlands': 'Europe', 'North Macedonia': 'Europe',
    'Norway': 'Europe', 'Poland': 'Europe', 'Portugal': 'Europe', 'Romania':␣
↪'Europe', 'Russia': 'Europe',
    'San Marino': 'Europe', 'Serbia': 'Europe', 'Slovakia': 'Europe', 'Slovenia':
↪ 'Europe', 'Spain': 'Europe',
    'Sweden': 'Europe', 'Switzerland': 'Europe', 'Ukraine': 'Europe', 'United␣
↪Kingdom': 'Europe', 'Vatican City': 'Europe',

    # North America
    'Antigua and Barbuda': 'North America', 'Bahamas': 'North America',␣
↪'Barbados': 'North America',
    'Belize': 'North America', 'Canada': 'North America', 'Costa Rica': 'North␣
↪America', 'Cuba': 'North America',
    'Dominica': 'North America', 'Dominican Republic': 'North America', 'El␣
↪Salvador': 'North America',
    'Grenada': 'North America', 'Guatemala': 'North America', 'Haiti': 'North␣
↪America', 'Honduras': 'North America',
    'Jamaica': 'North America', 'Mexico': 'North America', 'Nicaragua': 'North␣
↪America', 'Panama': 'North America',
    'Saint Kitts and Nevis': 'North America', 'Saint Lucia': 'North America',␣
↪'Saint Vincent and the Grenadines': 'North America',
    'Trinidad and Tobago': 'North America', 'United States': 'North America',

    # South America
    'Argentina': 'South America', 'Bolivia': 'South America', 'Brazil': 'South␣
↪America', 'Chile': 'South America',
    'Colombia': 'South America', 'Ecuador': 'South America', 'Guyana': 'South␣
↪America', 'Paraguay': 'South America',
    'Peru': 'South America', 'Suriname': 'South America', 'Uruguay': 'South␣
↪America', 'Venezuela': 'South America',
```

```
    # Oceania
    'Australia': 'Oceania', 'Fiji': 'Oceania', 'Kiribati': 'Oceania', 'Marshall␣
 ↪Islands': 'Oceania',
    'Micronesia': 'Oceania', 'Nauru': 'Oceania', 'New Zealand': 'Oceania',␣
 ↪'Palau': 'Oceania',
    'Papua New Guinea': 'Oceania', 'Samoa': 'Oceania', 'Solomon Islands':␣
 ↪'Oceania', 'Tonga': 'Oceania',
    'Tuvalu': 'Oceania', 'Vanuatu': 'Oceania'
}


df['continent'] = df['country_name'].map(country_to_continent)
```

[130]:
```
print(df[['country_name', 'continent']].head())
```

```
    country_name continent
16  Afghanistan      Asia
17  Afghanistan      Asia
18  Afghanistan      Asia
19  Afghanistan      Asia
20  Afghanistan      Asia
```

[30]:
```
# The top 10 countries by GDP in 2023 are identified
df[df['year'] == 2023].nlargest(10, 'GDP (Current USD)')[['country_name', 'GDP␣
 ↪(Current USD)']]
```

[30]:

|      | country_name          | GDP (Current USD) |
|------|-----------------------|-------------------|
| 3261 | United States         | 2.772071e+13      |
| 589  | China                 | 1.779478e+13      |
| 813  | Germany               | 4.525704e+12      |
| 1581 | Japan                 | 4.204495e+12      |
| 1437 | India                 | 3.567552e+12      |
| 1101 | United Kingdom        | 3.380855e+12      |
| 1037 | France                | 3.051832e+12      |
| 1533 | Italy                 | 2.300941e+12      |
| 429  | Brazil                | 2.173666e+12      |
| 3325 | British Virgin Islands| 2.173666e+12      |

[32]:
```
# The 10 countries with the lowest unemployment rates in 2024 are identified
df[df['year'] == 2024].nsmallest(10, 'Unemployment Rate (%)')[['country_name',␣
 ↪'Unemployment Rate (%)']]
```

[32]:

|      | country_name | Unemployment Rate (%) |
|------|--------------|-----------------------|
| 2622 | Qatar        | 0.126                 |
| 1646 | Cambodia     | 0.270                 |
| 2270 | Niger        | 0.355                 |
| 3054 | Thailand     | 0.693                 |
| 222  | Burundi      | 0.902                 |

| 3022 | Chad | 1.088 |
|------|------|-------|
| 318  | Bahrain | 1.102 |
| 1726 | Lao PDR | 1.218 |
| 3358 | Viet Nam | 1.431 |
| 1966 | Moldova | 1.434 |

[38]:
```python
# The global average inflation rate (CPI) is calculated for each year
df.groupby('year')['Inflation (CPI %)'].mean()

plt.figure(figsize=(10, 6))
plt.plot(inflation_by_year.index, inflation_by_year.values, marker='o',
 →linestyle='-', color='tab:red')
plt.title('Average Global Inflation (CPI %) by Year')
plt.xlabel('Year')
plt.ylabel('Average Inflation Rate (%)')
plt.grid(True)
plt.tight_layout()
plt.show()
```



Average Global Inflation (CPI %) by Year
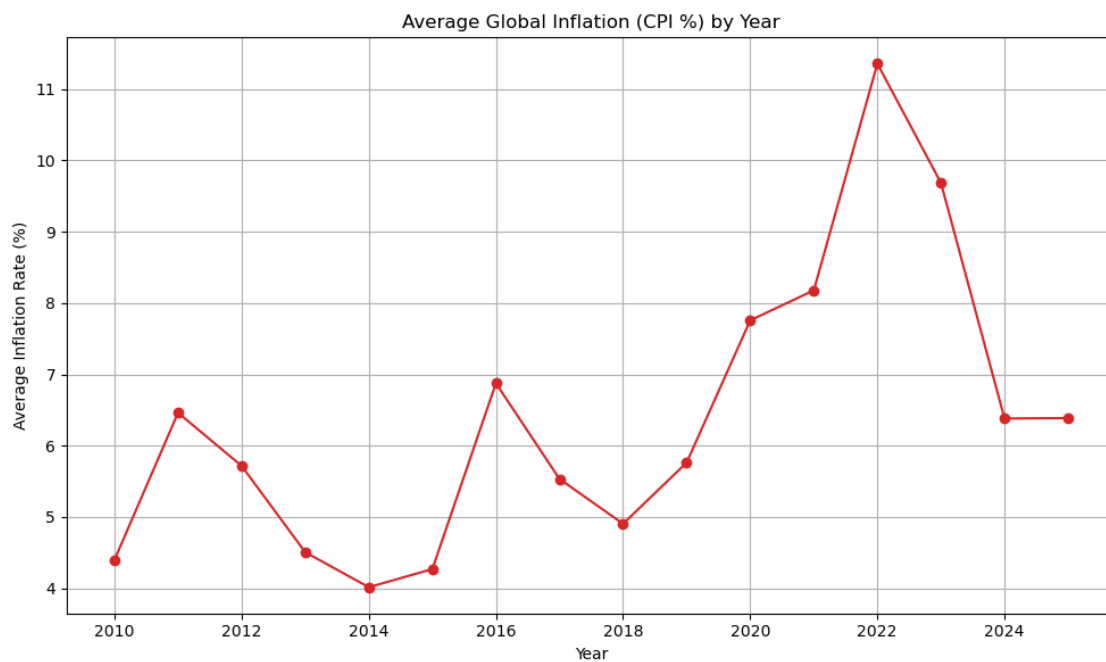
```
[40]: # The country with the highest annual economic growth is identified for each year
      df.loc[df.groupby('year')['GDP Growth (% Annual)'].idxmax()][['year',
       →'country_name', 'GDP Growth (% Annual)']]
```

[40]:

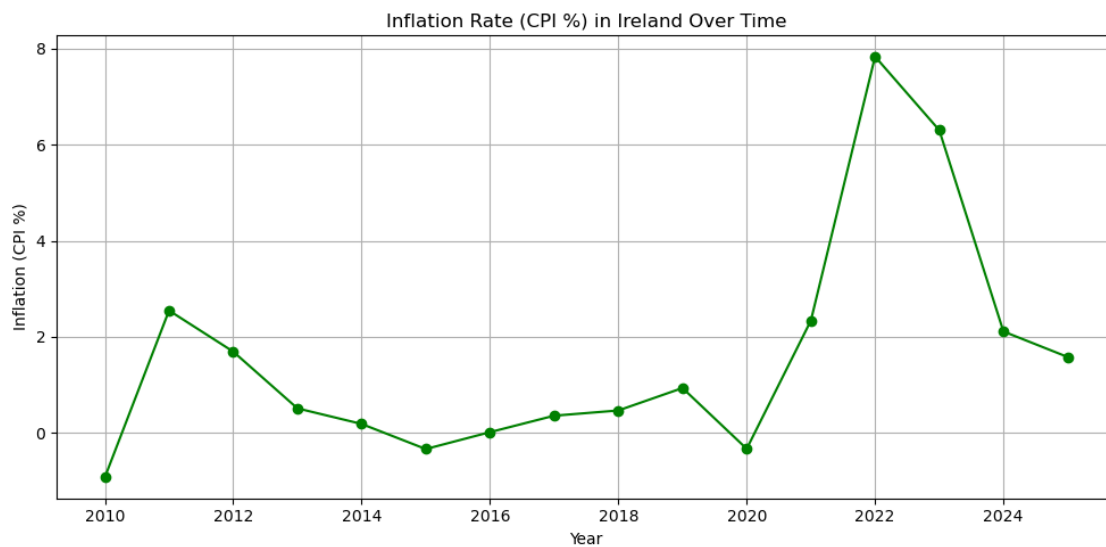| | year | country_name | GDP Growth (% Annual) |
|---|---|---|---|
| 1888 | 2010 | Macao SAR, China | 25.122809 |
| 1889 | 2011 | Macao SAR, China | 21.616690 |
| 1762 | 2012 | Libya | 86.826748 |
| 2755 | 2013 | Sierra Leone | 21.079014 |
| 2356 | 2014 | Nauru | 16.423336 |
| 1445 | 2015 | Ireland | 24.615570 |
| 2134 | 2016 | Northern Mariana Islands | 29.212121 |
| 1767 | 2017 | Libya | 32.491802 |
| 1800 | 2018 | Liechtenstein | 10.155818 |
| 3097 | 2019 | Timor-Leste | 24.212884 |
| 1306 | 2020 | Guyana | 43.479652 |
| 1995 | 2021 | Maldives | 37.507870 |
| 1308 | 2022 | Guyana | 63.334587 |
| 1901 | 2023 | Macao SAR, China | 75.061377 |
| 1902 | 2024 | Macao SAR, China | 75.061377 |
| 1903 | 2025 | Macao SAR, China | 75.061377 |

```
[42]: # Inflation trends over time are analyzed for a specific country (Ireland)
      df[df['country_name'] == 'Ireland'][['year', 'Inflation (CPI %)']]
```

[42]:

| | year | Inflation (CPI %) |
|---|---|---|
| 1440 | 2010 | -0.918389 |
| 1441 | 2011 | 2.548978 |
| 1442 | 2012 | 1.694741 |
| 1443 | 2013 | 0.515099 |
| 1444 | 2014 | 0.190916 |
| 1445 | 2015 | -0.330960 |
| 1446 | 2016 | 0.020125 |
| 1447 | 2017 | 0.362173 |
| 1448 | 2018 | 0.471131 |
| 1449 | 2019 | 0.937843 |
| 1450 | 2020 | -0.326184 |
| 1451 | 2021 | 2.340341 |
| 1452 | 2022 | 7.829457 |
| 1453 | 2023 | 6.299425 |
| 1454 | 2024 | 2.113450 |
| 1455 | 2025 | 1.583210 |

```
[56]: #matplotlib
      ireland_inflation = df[df['country_name'] == 'Ireland'][['year', 'Inflation (CPI␣
       ↪%)']]

      plt.figure(figsize=(10, 5))
      plt.plot(ireland_inflation['year'], ireland_inflation['Inflation (CPI %)'],␣
       ↪marker='o', linestyle='-', color='green')
      plt.title('Inflation Rate (CPI %) in Ireland Over Time')
      plt.xlabel('Year')
      plt.ylabel('Inflation (CPI %)')
      plt.grid(True)
      plt.tight_layout()
      plt.show()
```



```
[48]: # GDP growth is compared across selected countries
      df[df['country_name'].isin(['United States', 'China', 'India'])][['year',␣
       ↪'country_name', 'GDP Growth (% Annual)']]
```

```
[48]:       year   country_name  GDP Growth (% Annual)
      576   2010          China               10.635871
      577   2011          China                9.550832
      578   2012          China                7.863736
      579   2013          China                7.766150
      580   2014          China                7.425764
      581   2015          China                7.041329
      582   2016          China                6.848762
      583   2017          China                6.947201
      584   2018          China                6.749774
```

9

| | | | |
|---|---|---|---|
| 585 | 2019 | China | 5.950501 |
| 586 | 2020 | China | 2.238638 |
| 587 | 2021 | China | 8.448469 |
| 588 | 2022 | China | 2.950670 |
| 589 | 2023 | China | 5.249558 |
| 590 | 2024 | China | 5.249558 |
| 591 | 2025 | China | 5.249558 |
| 1424 | 2010 | India | 8.497585 |
| 1425 | 2011 | India | 5.241316 |
| 1426 | 2012 | India | 5.456388 |
| 1427 | 2013 | India | 6.386106 |
| 1428 | 2014 | India | 7.410228 |
| 1429 | 2015 | India | 7.996254 |
| 1430 | 2016 | India | 8.256306 |
| 1431 | 2017 | India | 6.795383 |
| 1432 | 2018 | India | 6.453851 |
| 1433 | 2019 | India | 3.871437 |
| 1434 | 2020 | India | -5.777725 |
| 1435 | 2021 | India | 9.689592 |
| 1436 | 2022 | India | 6.987039 |
| 1437 | 2023 | India | 8.152936 |
| 1438 | 2024 | India | 8.152936 |
| 1439 | 2025 | India | 8.152936 |
| 3248 | 2010 | United States | 2.695193 |
| 3249 | 2011 | United States | 1.564407 |
| 3250 | 2012 | United States | 2.289113 |
| 3251 | 2013 | United States | 2.117830 |
| 3252 | 2014 | United States | 2.523820 |
| 3253 | 2015 | United States | 2.945550 |
| 3254 | 2016 | United States | 1.819451 |
| 3255 | 2017 | United States | 2.457622 |
| 3256 | 2018 | United States | 2.966505 |
| 3257 | 2019 | United States | 2.583825 |
| 3258 | 2020 | United States | -2.163029 |
| 3259 | 2021 | United States | 6.055053 |
| 3260 | 2022 | United States | 2.512375 |
| 3261 | 2023 | United States | 2.887556 |
| 3262 | 2024 | United States | 2.887556 |
| 3263 | 2025 | United States | 2.887556 |

[50]:
```python
# China's GDP growth over time is visualized using a line chart
china = df[df['country_name'] == 'China']
plt.plot(china['year'], china['GDP Growth (% Annual)'])
plt.title('GDP Growth - China')
plt.xlabel('Year')
plt.ylabel('Growth %')
plt.grid()
plt.show()
```



GDP Growth – China

```
[60]: # The top 20 countries with the highest public debt as a percentage of GDP are
      →identified
      df[df['year'] == 2023].nlargest(20, 'Public Debt (% of GDP)')[['country_name',
      →'Public Debt (% of GDP)']]
```

```
[60]:                 country_name  Public Debt (% of GDP)
      1581                   Japan               216.213375
      1229                  Greece               190.608142
      1261               Greenland               190.608142
      1245                 Grenada               190.608142
      1293                    Guam               190.608142
      2733               Singapore               177.001670
      2957  Sint Maarten (Dutch part)             177.001670
      1101          United Kingdom               138.193490
      445                 Barbados               133.202198
      3261           United States               114.755553
      317                  Bahrain               111.598089
      285               Bangladesh               111.598089
      477                   Bhutan               111.007884
      413                  Bolivia               111.007884
      957                    Spain               107.259969
      1549                 Jamaica               106.282373
      2797               San Marino               103.153573
      2861    Sao Tome and Principe               103.153573
      2685            Saudi Arabia               103.153573
      2717                  Senegal               103.153573
```

```
[64]: # The 20 countries with the lowest public debt as a percentage of GDP are
      →identified
      df[df['year'] == 2023].nsmallest(20, 'Public Debt (% of GDP)')[['country_name',
      →'Public Debt (% of GDP)']]
```

```
[64]:                 country_name  Public Debt (% of GDP)
      93      United Arab Emirates                 1.845685
      1837                 Lesotho                 2.992717
      2749         Solomon Islands                15.393166
      2813                 Somalia                15.393166
      637         Congo, Dem. Rep.                15.989697
      205               Azerbaijan                16.822427
      2653      Russian Federation                18.961672
      2669                  Rwanda                18.961672
      3389                   Samoa                18.961672
      493                 Botswana                19.616081
      541              Switzerland                20.095389
```

```
2989  Syrian Arab Republic                     20.095389
3069            Tajikistan                     20.095389
3197              Tanzania                     20.095389
1757              Liberia                      20.317995
1773                Libya                      20.317995
1805        Liechtenstein                      20.317995
1597          Kazakhstan                       20.822090
1613               Kenya                       20.822090
1661            Kiribati                       20.822090
```

[66]: *# Changes in GDP per capita over time are analyzed for Germany*
df[df['country_name'] == 'Germany'][['year', 'GDP per Capita (Current USD)']]

[66]:
```
       year  GDP per Capita (Current USD)
800    2010                  42409.935699
801    2011                  47646.582043
802    2012                  44735.588232
803    2013                  47220.010210
804    2014                  48971.082472
805    2015                  41911.010985
806    2016                  42961.035691
807    2017                  45526.599958
808    2018                  48874.859503
809    2019                  47623.865607
810    2020                  47379.765195
811    2021                  52265.654162
812    2022                  49686.115458
813    2023                  54343.226508
814    2024                  54343.226508
815    2025                  54343.226508
```

```
[68]: #Average Global Inflation per Year
      df.groupby('year')['Inflation (CPI %)'].mean().plot(kind='line', title='Average␣
       ↪Global Inflation per Year')
      plt.ylabel('Inflation (%)')
      plt.show()
```



Average Global Inflation per Year
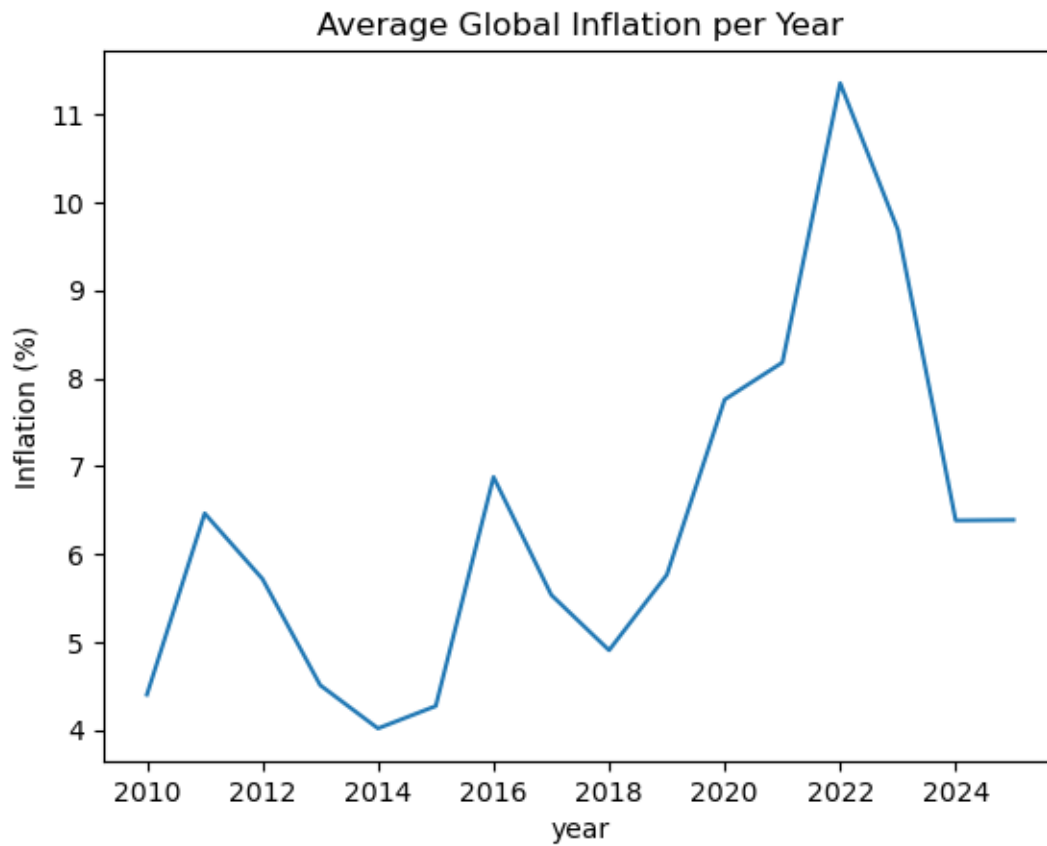
```python
[78]:  # The 10 countries that experienced the highest inflation (CPI) in 2023 are
       →identified
       df[df['year'] == 2023].nlargest(10, 'Inflation (CPI %)')[['country_name',
       →'Inflation (CPI %)']]
```

```
[78]:           country_name  Inflation (CPI %)
      1741            Lebanon         221.341644
      3469           Zimbabwe          79.611351
      3309       Venezuela, RB          79.263053
      2701              Sudan          75.578432
      3165            Turkiye          53.859409
      2877           Suriname          51.587316
      2765       Sierra Leone          47.642873
      1469  Iran, Islamic Rep.          44.579186
      1133              Ghana          38.106966
      1373              Haiti          36.813516
```

```python
[80]:  # The countries with the worst economic performance in 2023 are identified
       df[df['year'] == 2023].nsmallest(10, 'GDP Growth (% Annual)')[['country_name',
       →'GDP Growth (% Annual)']]
```

```
[80]:            country_name  GDP Growth (% Annual)
      2701              Sudan             -20.111576
      3101        Timor-Leste             -18.117813
      2845        South Sudan             -10.793365
      1453            Ireland              -5.530007
      2589  West Bank and Gaza              -5.410937
      1213   Equatorial Guinea              -5.089309
      2029    Marshall Islands              -3.934871
      3309        Venezuela, RB              -3.894386
      1709             Kuwait              -3.640426
      973             Estonia              -3.023036
```

```
[84]:  # The change in inflation in Sudan over the years is visualized using a line␣
       ↪chart
       df[df['country_name'] == 'Sudan'].plot(x='year', y='Inflation (CPI %)',␣
       ↪kind='line', title='Sudan Inflation Trend')
       plt.ylabel('Inflation (%)')
       plt.show()
```
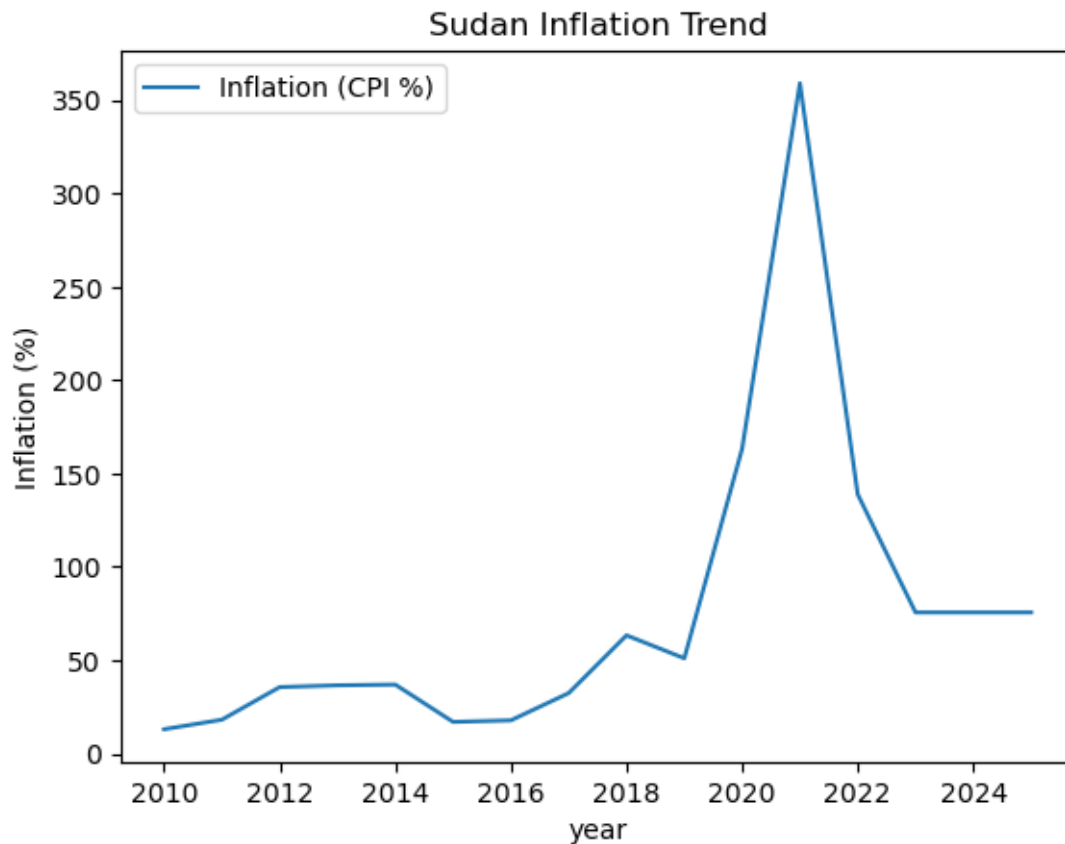


```
[88]:  # The average inflation rate in 2010 and 2023 is calculated for all countries in␣
       ↪the dataset
       df[df['year'].isin([2010, 2023])].groupby('year')['Inflation (CPI %)'].mean()
```

```
[88]:  year
       2010    4.398032
       2023    9.684955
       Name: Inflation (CPI %), dtype: float64
```

```
[94]: # The 20 countries with the highest government spending as a percentage of GDP
      →in 2023 are identified
      df[df['year'] == 2023].nlargest(20, 'Government Expense (% of
      →GDP)')[['country_name', 'Government Expense (% of GDP)']]
```

```
[94]:                    country_name  Government Expense (% of GDP)
      2365                     Nauru                      103.725787
      1661                  Kiribati                       87.412005
      2541  Korea, Dem. People's Rep.                      87.412005
      3229                   Ukraine                       66.463888
      2029          Marshall Islands                       59.443177
      2173                Mauritania                       59.443177
      2477                     Palau                       58.953595
      3101               Timor-Leste                       52.493598
      1533                     Italy                       47.604903
      1037                    France                       47.326465
      2605          French Polynesia                       47.326465
      1229                    Greece                       47.194701
      1261                 Greenland                       47.194701
      1245                   Grenada                       47.194701
      1293                      Guam                       47.194701
      189                    Austria                       46.478874
      1005                   Finland                       44.854383
      2797                San Marino                       44.640643
      2861     Sao Tome and Principe                       44.640643
      1869                Luxembourg                       43.726281
```

```
[102]: # Japan's inflation rates for the years 2010, 2020, and 2023 are examined to
       →assess changes before and after the COVID-19
       df[(df['country_name'] == 'Japan') & (df['year'].isin([2010, 2020,
       →2023]))][['year', 'Inflation (CPI %)']]
```

```
[102]:       year  Inflation (CPI %)
       1568  2010          -0.728243
       1578  2020          -0.024996
       1581  2023           3.268134
```

```
[106]: # The top 20 countries with the highest tax revenue as a percentage of GDP in
       ↪2025 are identified
       df[df['year'] == 2025].nlargest(20, 'Tax Revenue (% of GDP)')[['country_name',
       ↪'Tax Revenue (% of GDP)']]
```

```
[106]:        country_name  Tax Revenue (% of GDP)
       2367          Nauru               44.402265
       863         Denmark               31.404169
       831        Djibouti               31.404169
       847        Dominica               31.404169
       1839        Lesotho               30.442549
       2383    New Zealand               29.933857
       1871     Luxembourg               27.796776
       2927         Sweden               27.604753
       1103  United Kingdom              27.318863
       2239        Namibia               27.171548
       2335         Norway               26.921057
       2399           Oman               26.921057
       2415       Pakistan               26.921057
       1231         Greece               26.633583
       1263      Greenland               26.633583
       1247        Grenada               26.633583
       1295           Guam               26.633583
       3439   South Africa               26.005460
       2847    South Sudan               26.005460
       191         Austria               25.890495
```

```
[154]: # A heatmap of correlations between all numerical variables in the dataset is
       ↪generated
       sns.heatmap(df.select_dtypes('number').corr(), cmap='coolwarm', annot=False)
       plt.title('Correlation Matrix')
       plt.show()
```

Correlation Matrix
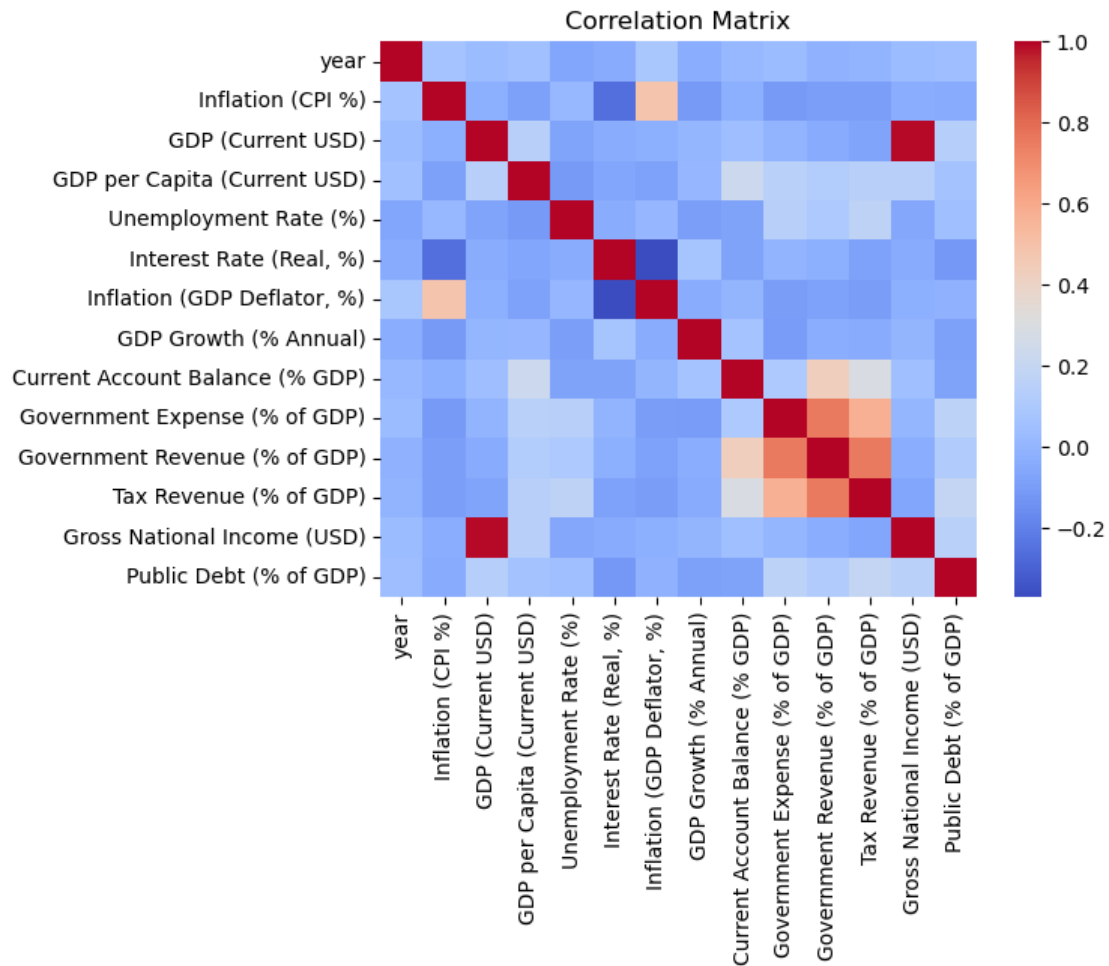
```
[142]: # Unemployment Trends by Continent (2010-2025)
       # Changes in unemployment rates across continents over the years are analyzed

       df_clean.groupby(['continent', 'year'])['Unemployment Rate (%)'].mean().
       ↪unstack().T.plot(figsize=(10,6))
       plt.title('Unemployment Trends by Continent (2010-2025)')
       plt.ylabel('Unemployment Rate (%)')
       plt.xlabel('Year')
       plt.grid(True)
       plt.show()
```

Unemployment Trends by Continent (2010–2025)
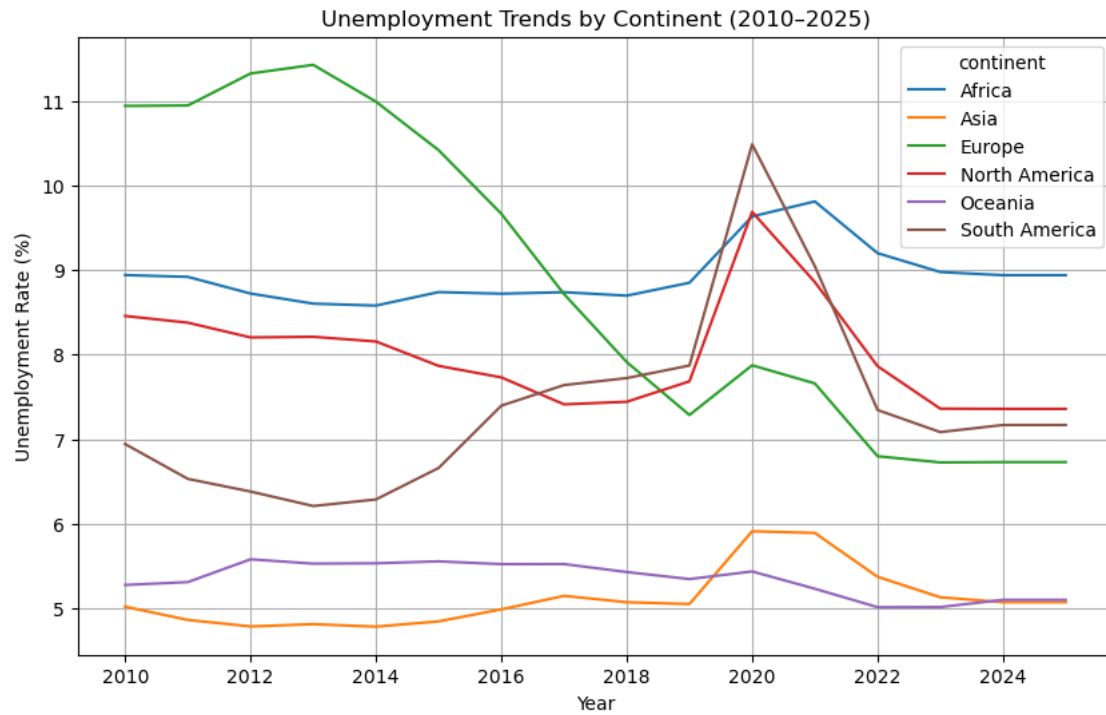
[144]:
```
variation = df_clean.groupby('continent')['Unemployment Rate (%)'].agg(lambda x:
    ↪x.max() - x.min())
print(variation.sort_values(ascending=False))
```

```
continent
Africa           35.043
Europe           32.350
North America    24.345
Asia             19.737
Oceania          18.454
South America    13.962
Name: Unemployment Rate (%), dtype: float64
```

```
[136]:  #Average Unemployment Rate by Continent
        avg_unemployment_by_continent.plot(kind='bar', title='Average Unemployment Rate␣
         ↪by Continent', figsize=(8, 5))
        plt.ylabel('Unemployment Rate (%)')
        plt.xlabel('Continent')
        plt.grid(True)
        plt.show()
```

Average Unemployment Rate by Continent
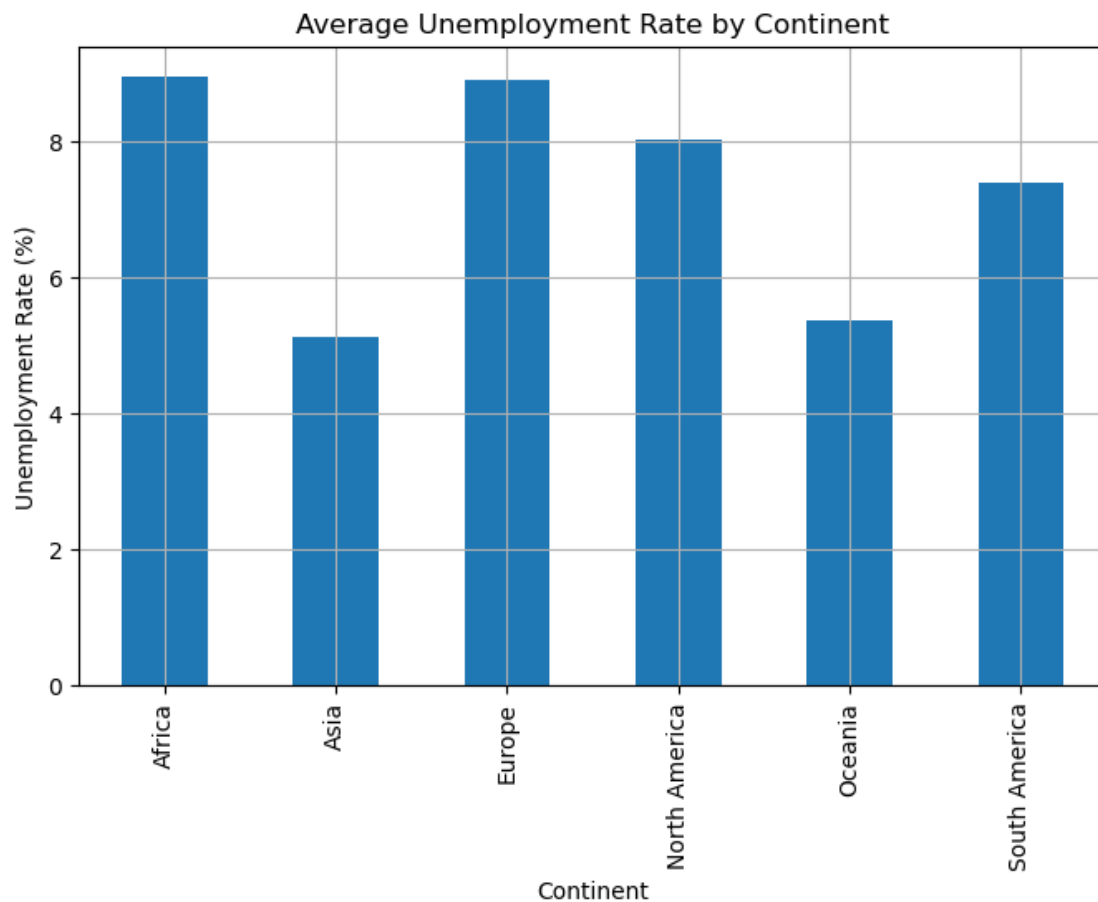
[150]:
```
# The evolution of average GDP by continent is analyzed over time
gdp_trend = df_clean.groupby(['continent', 'year'])['GDP (Current USD)'].mean().
 ↪unstack()
gdp_trend.T.plot(figsize=(12, 6), title='Average GDP by Continent Over Time')
plt.ylabel('GDP (Current USD)')
plt.xlabel('Year')
plt.grid(True)
plt.show()
```
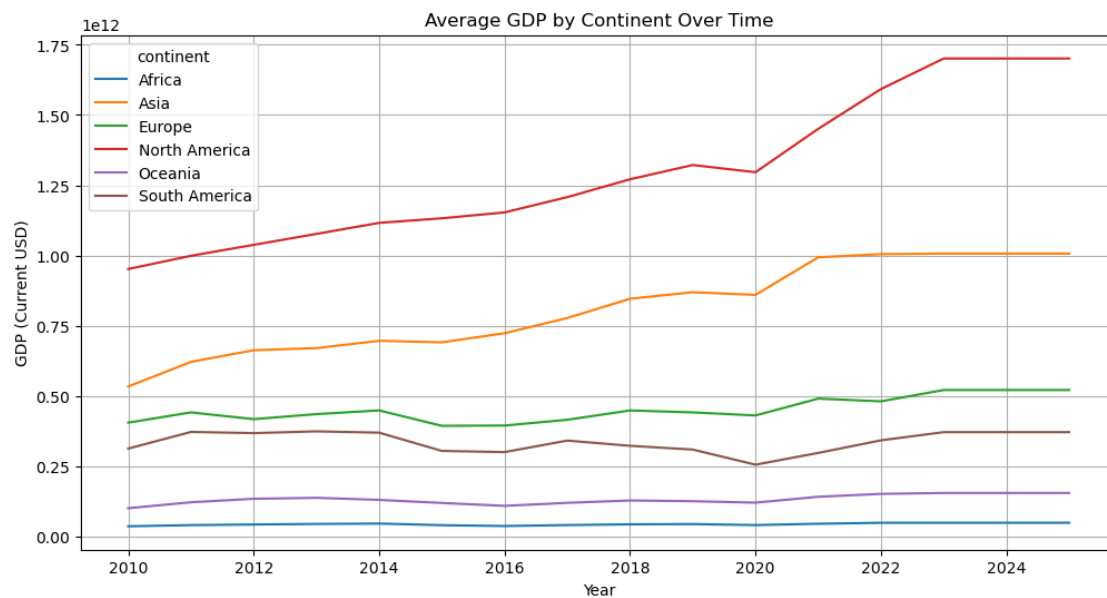
[148]:
```
# Inflation rates are compared across continents for a specific year (2023)
df_2023 = df_clean[df_clean['year'] == 2023]
df_2023.groupby('continent')['Inflation (CPI %)'].mean().sort_values().
 ↪plot(kind='barh', title='Average Inflation by Continent - 2023')
plt.xlabel('Inflation (CPI %)')
plt.grid(True)
plt.show()
```
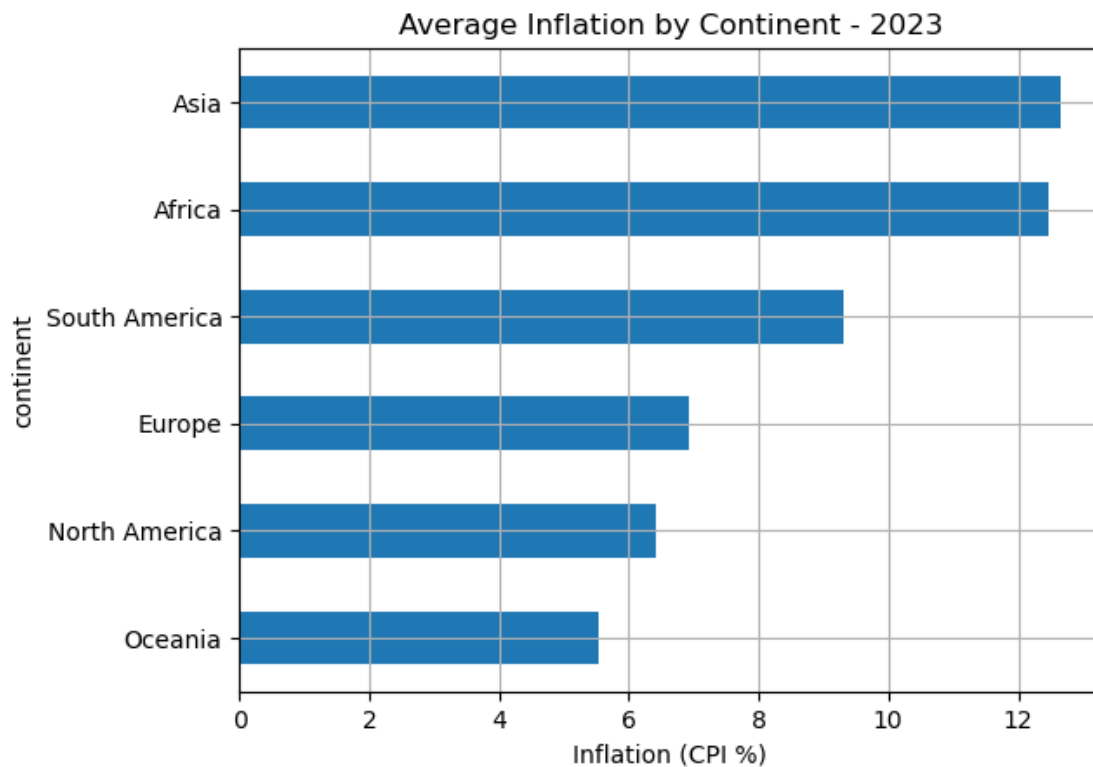
[158]: 
```python
# GDP per capita is compared across different continents
df_clean.groupby('continent')['GDP per Capita (Current USD)'].mean().
 →sort_values().plot(kind='bar', title='Average GDP per Capita by Continent')
plt.ylabel('GDP per Capita (USD)')
plt.grid(True)
plt.show()
```

Average GDP per Capita by Continent
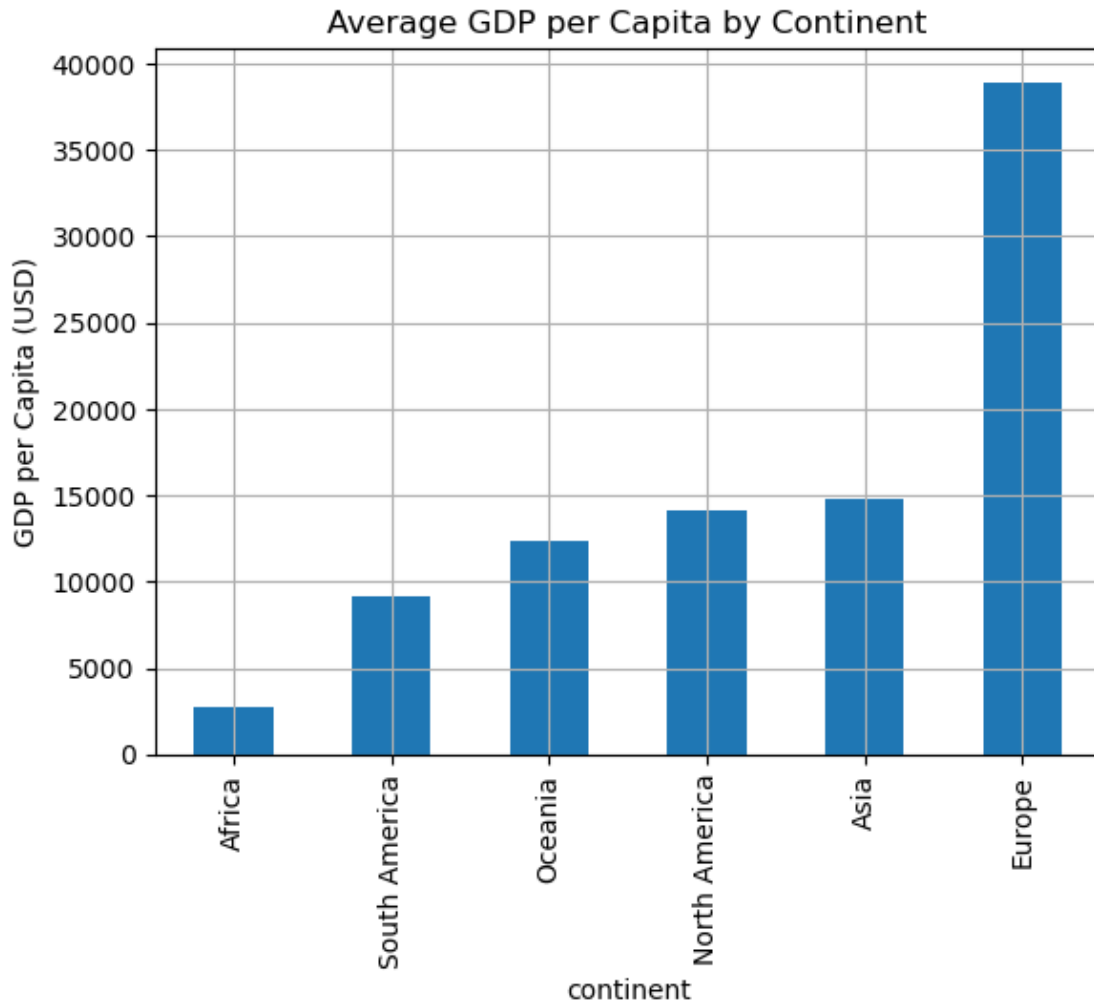


[160]: 
```python
# Government spending as a percentage of GDP is analyzed across continents
df_clean.groupby('continent')['Government Expense (% of GDP)'].mean().
 →plot(kind='barh', color='skyblue')
plt.title('Avg Government Expense as % of GDP by Continent')
plt.xlabel('% of GDP')
```

```
plt.grid(True)
plt.show()
```



Avg Government Expense as % of GDP by Continent
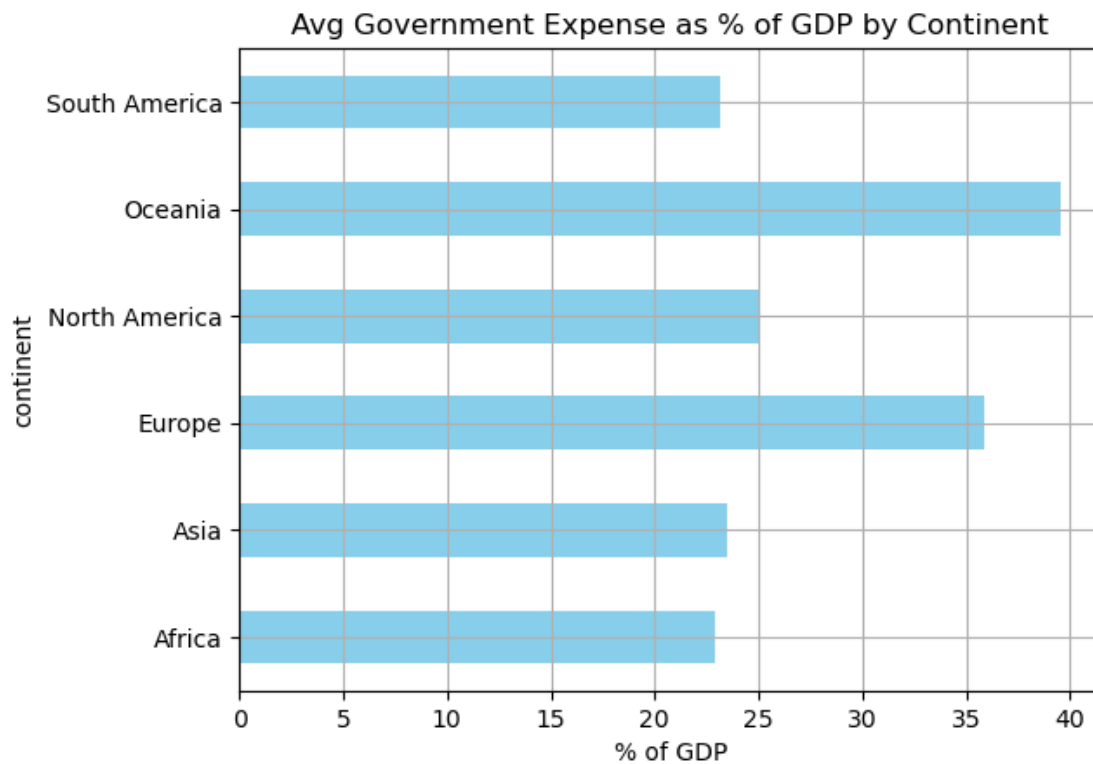
[174]:
```
# Countries with the highest and lowest unemployment rates within each continent␣
 ↪in 2023 are identified
for cont in df_clean['continent'].unique():
    top = df_clean[(df_clean['continent'] == cont) & (df_clean['year'] == 2023)]
    top_sorted = top.sort_values(by='Unemployment Rate (%)', ascending=False)
    print("\n{cont} - Highest Unemployment:\n", top_sorted[['country_name',␣
 ↪'Unemployment Rate (%)']].head(3))
    print("\n{cont} - Lowest Unemployment:\n", top_sorted[['country_name',␣
 ↪'Unemployment Rate (%)']].tail(3))
```

```
{cont} - Highest Unemployment:
      country_name  Unemployment Rate (%)
1565        Jordan                 17.969
1485          Iraq                 15.447
29     Afghanistan                 13.991

{cont} - Lowest Unemployment:
      country_name  Unemployment Rate (%)
```

```
3053     Thailand              0.733
1645     Cambodia              0.225
2621       Qatar               0.130


{cont} - Highest Unemployment:
        country_name  Unemployment Rate (%)
1805  Liechtenstein              18.615
2109     Montenegro             14.621
125        Armenia              13.245


{cont} - Lowest Unemployment:
      country_name  Unemployment Rate (%)
3405       Kosovo               2.604
1965      Moldova               1.555
1949       Monaco               1.434


{cont} - Highest Unemployment:
       country_name  Unemployment Rate (%)
2941     Eswatini              35.086
3437  South Africa            32.098
829      Djibouti             26.154


{cont} - Lowest Unemployment:
      country_name  Unemployment Rate (%)
3021        Chad                1.074
221       Burundi               0.921
2269       Niger                0.425


{cont} - Highest Unemployment:
           country_name  Unemployment Rate (%)
845            Dominica               25.875
1373              Haiti              14.556
157   Antigua and Barbuda            14.464


{cont} - Lowest Unemployment:
      country_name  Unemployment Rate (%)
2013       Mexico               2.765
1277     Guatemala             2.344
733         Cuba                1.719


{cont} - Highest Unemployment:
      country_name  Unemployment Rate (%)
1309       Guyana              12.025
669      Colombia              9.594
573        Chile               9.013


{cont} - Lowest Unemployment:
      country_name  Unemployment Rate (%)
```

```
2445        Peru                    4.899
909        Ecuador                  3.510
413        Bolivia                  3.024


{cont} - Highest Unemployment:
      country_name  Unemployment Rate (%)
2365        Nauru                   19.148
2477        Palau                    5.472
1661      Kiribati                   5.434


{cont} - Lowest Unemployment:
          country_name  Unemployment Rate (%)
2493  Papua New Guinea               2.661
3117            Tonga                2.262
2749  Solomon Islands                1.455
```
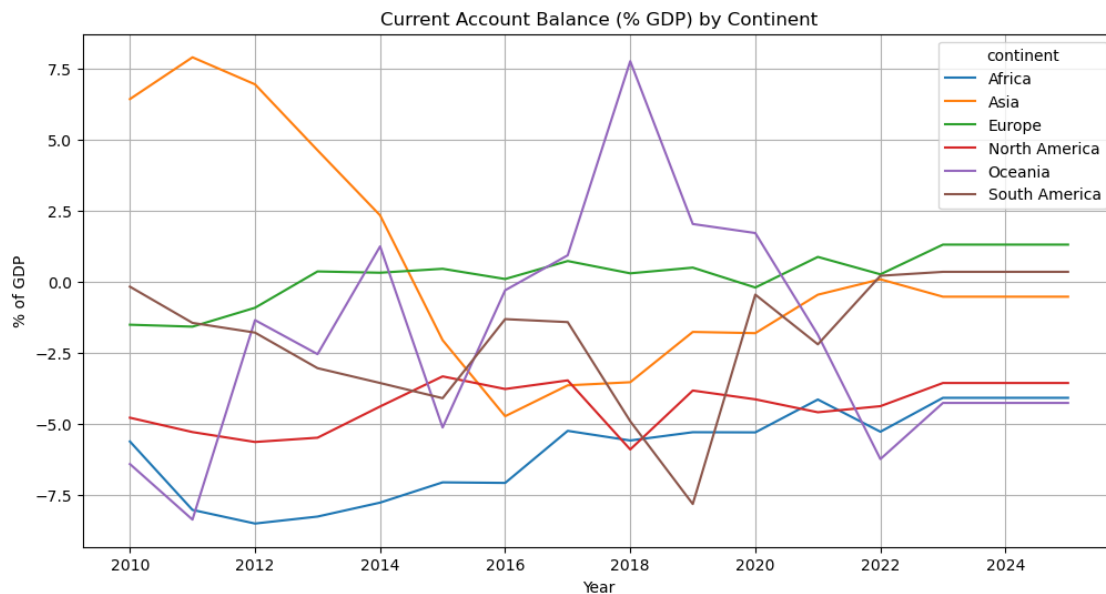
[178]:
```python
# The evolution of current account surplus/deficit as a percentage of GDP is␣
↪analyzed for each continent
balance = df_clean.groupby(['continent', 'year'])['Current Account Balance (%␣
↪GDP)'].mean().unstack()
balance.T.plot(figsize=(12, 6), title='Current Account Balance (% GDP) by␣
↪Continent')
plt.ylabel('% of GDP')
plt.xlabel('Year')
plt.grid(True)
plt.show()
```

```
[176]: # The most indebted countries in each continent for the latest available year
       ↪are identified
       latest_year = df_clean['year'].max()
       df_latest = df_clean[df_clean['year'] == latest_year]
       for cont in df_latest['continent'].unique():
           sub = df_latest[df_latest['continent'] == cont]
           top_debt = sub.sort_values(by='Public Debt (% of GDP)', ascending=False).
       ↪head(3)
           print("\n{cont} - Highest Public Debt in {latest_year}:\n",
       ↪top_debt[['country_name', 'Public Debt (% of GDP)']])
```

```
{cont} - Highest Public Debt in {latest_year}:
      country_name  Public Debt (% of GDP)
1583         Japan              216.213375
2735     Singapore              177.001670
287     Bangladesh              111.598089

{cont} - Highest Public Debt in {latest_year}:
       country_name  Public Debt (% of GDP)
1231          Greece              190.608142
1103  United Kingdom              138.193490
959            Spain              107.259969

{cont} - Highest Public Debt in {latest_year}:
      country_name  Public Debt (% of GDP)
2767  Sierra Leone              103.153573
2975    Seychelles              103.153573
2719        Senegal              103.153573

{cont} - Highest Public Debt in {latest_year}:
       country_name  Public Debt (% of GDP)
1247         Grenada              190.608142
447         Barbados              133.202198
3263   United States              114.755553

{cont} - Highest Public Debt in {latest_year}:
      country_name  Public Debt (% of GDP)
415        Bolivia              111.007884
431         Brazil               83.698937
111      Argentina               81.920133

{cont} - Highest Public Debt in {latest_year}:
      country_name  Public Debt (% of GDP)
2479         Palau               85.202576
2367         Nauru               76.635061
3375       Vanuatu               71.653573
```

```
[156]:  # A heatmap of correlations between indicators within each continent is generated
        for cont in df_clean['continent'].unique():
            subset = df_clean[df_clean['continent'] == cont].select_dtypes('number')
            plt.figure(figsize=(8, 5))
            sns.heatmap(subset.corr(), annot=False, cmap='coolwarm')
            plt.title(f'Correlation Matrix - {cont}')
            plt.show()
```



Correlation Matrix - Asia

Correlation Matrix - Europe

Correlation Matrix - Africa

Correlation Matrix - North America

Correlation Matrix - South America

Correlation Matrix - Oceania