

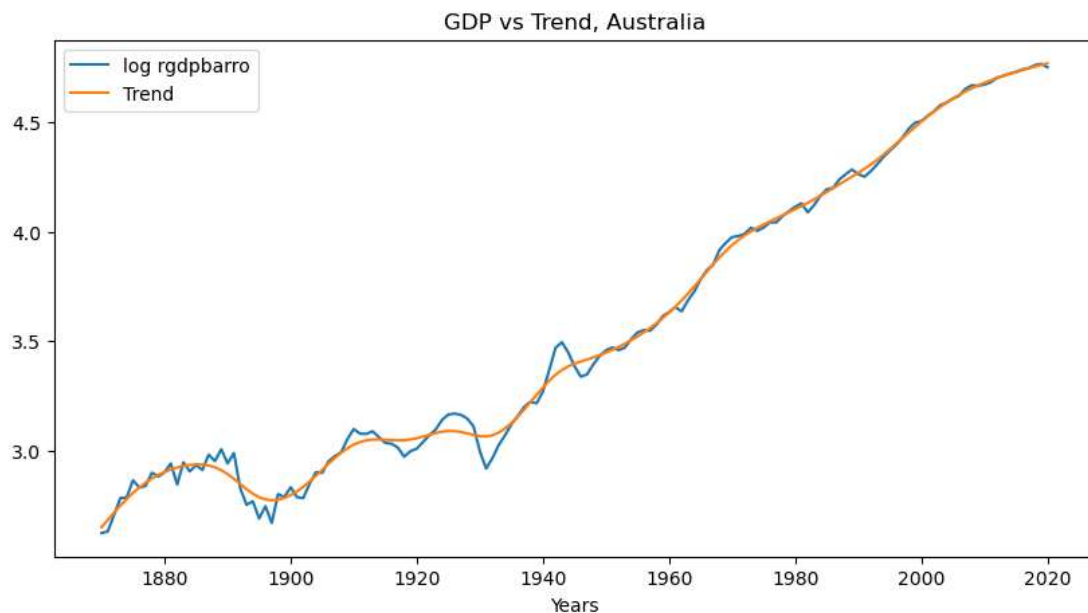
Insights into Australia's Economy

Dynamic Macro Group

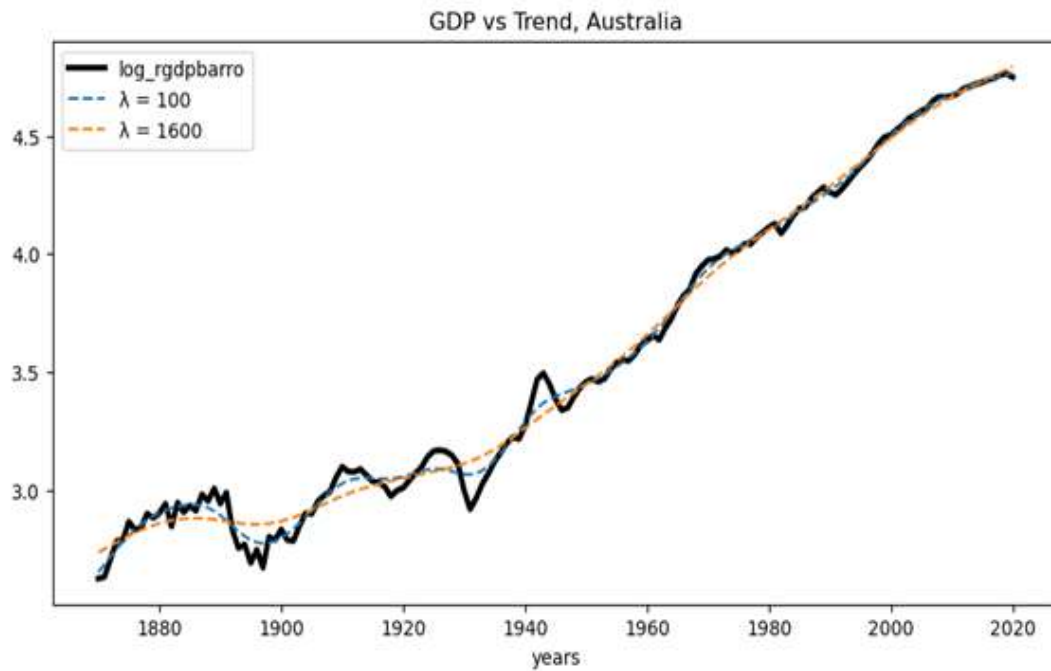
Team: Maria Papangeli, Alexandra Chairopoulou

Clarification: To compute the following plots we used data from the Macro History Database (Released by MacroFinance and MacroHistory Lab hosted at the Kiel Institute for the World Economy and affiliated with the ECONtribute Excellence Cluster).

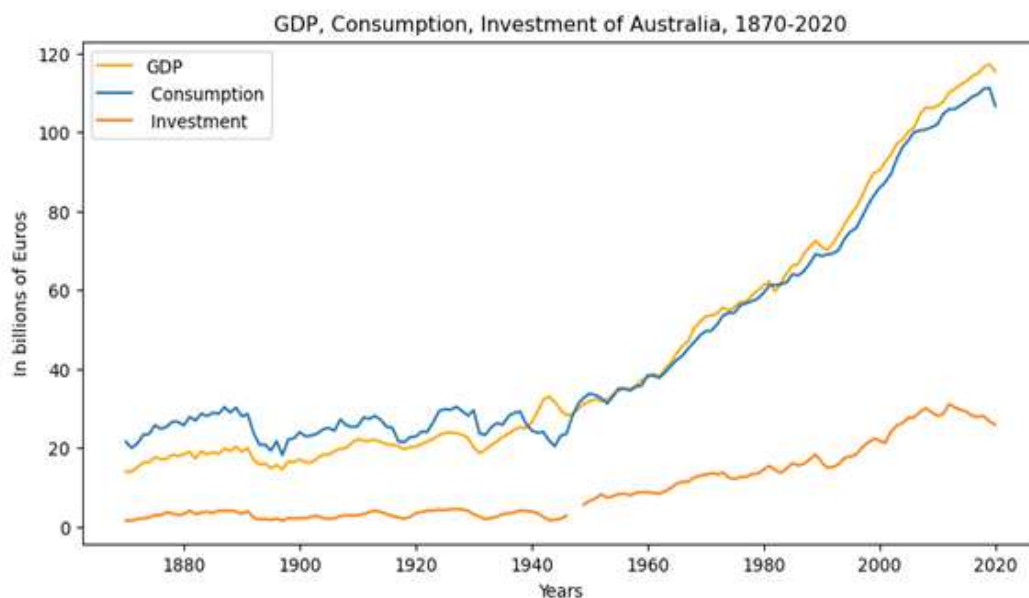
1) Business cycle analysis of Australia



The plot above shows the logarithm of real GDP (rgdpbarro) for Australia from 1870 to 2020, compared to its trend. We chose the variable rgdpbarro because it provides an index of real GDP per capita, with 2005 as the base year. This index allows us to notice changes in Australia's real GDP per capita relative to a common reference point. The blue line represents the actual log of real GDP, while the orange line represents the trend. To compute the trend, we used the Hodrick-Prescott (HP) filter in Python. This filter is a popular method for data-smoothing, enabling us to better focus on the underlying trends in Australia's GDP over time. The data indicates periods where GDP was above or below the trend, capturing economic fluctuations such as growth, recessions, and recoveries over time. More specifically, we notice that in the period 1900-1920 there is a notable volatility. Particularly, around 1910, the GDP rises above the trend, followed by a sharp dip around 1915 (likely due to World War I). Afterwards, significant deviations are seen in 1920-1940. A sharp decline occurs in the early 1930s, coinciding with the Great Depression. There is a steep recovery in GDP after World War II (1940-1950), with the economy performing above trend, especially during the late 1940s. A small dip appears after 2008, likely reflecting the impact of the Global Financial Crisis. Australia's economy was resilient due to its strong mining sector. A return to trend growth is visible towards 2020.



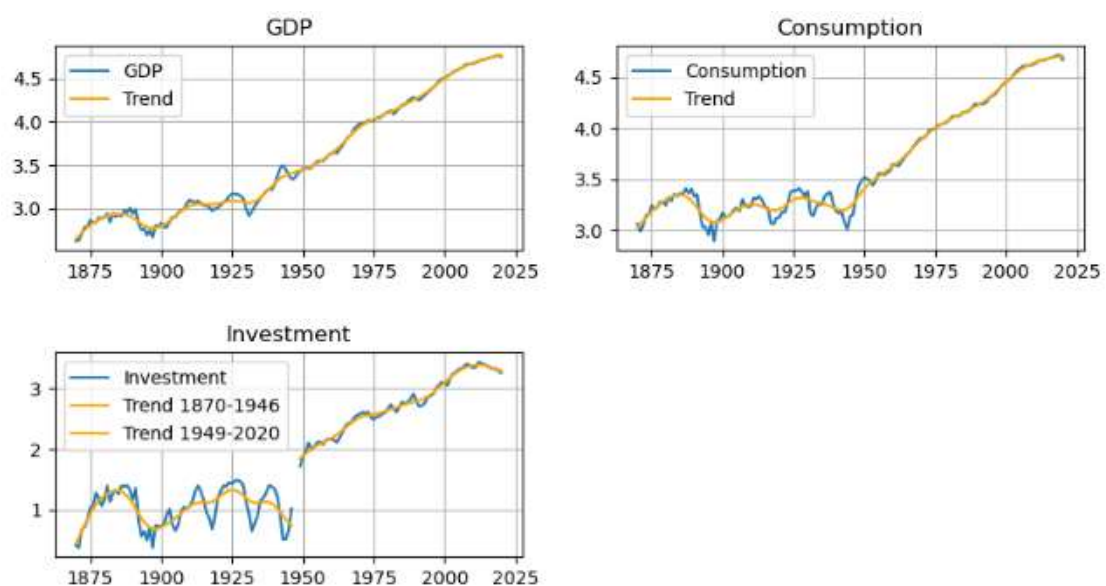
This plot shows the log of real GDP (rgdpbarro) for Australia from 1870 to 2020 (black line) and compares it to two different trends based on the Hodrick-Prescott (HP) filter with different smoothing parameters ($\lambda=100$, $\lambda=1600$). The parameter $\lambda=100$ is widely accepted for annual frequency capturing moderate smoothing while the parameter $\lambda=1600$ shows the conventional value used for quarterly data capturing high smoothing. The comparison highlights how different smoothing parameters affect the representation of GDP trends, with the higher $\lambda = 1600$ capturing more of the short-term cyclical deviations from the trend.



The plot shows the trends of GDP, Consumption, and Investment in Australia from 1870 to 2020, measured in billions of euros:

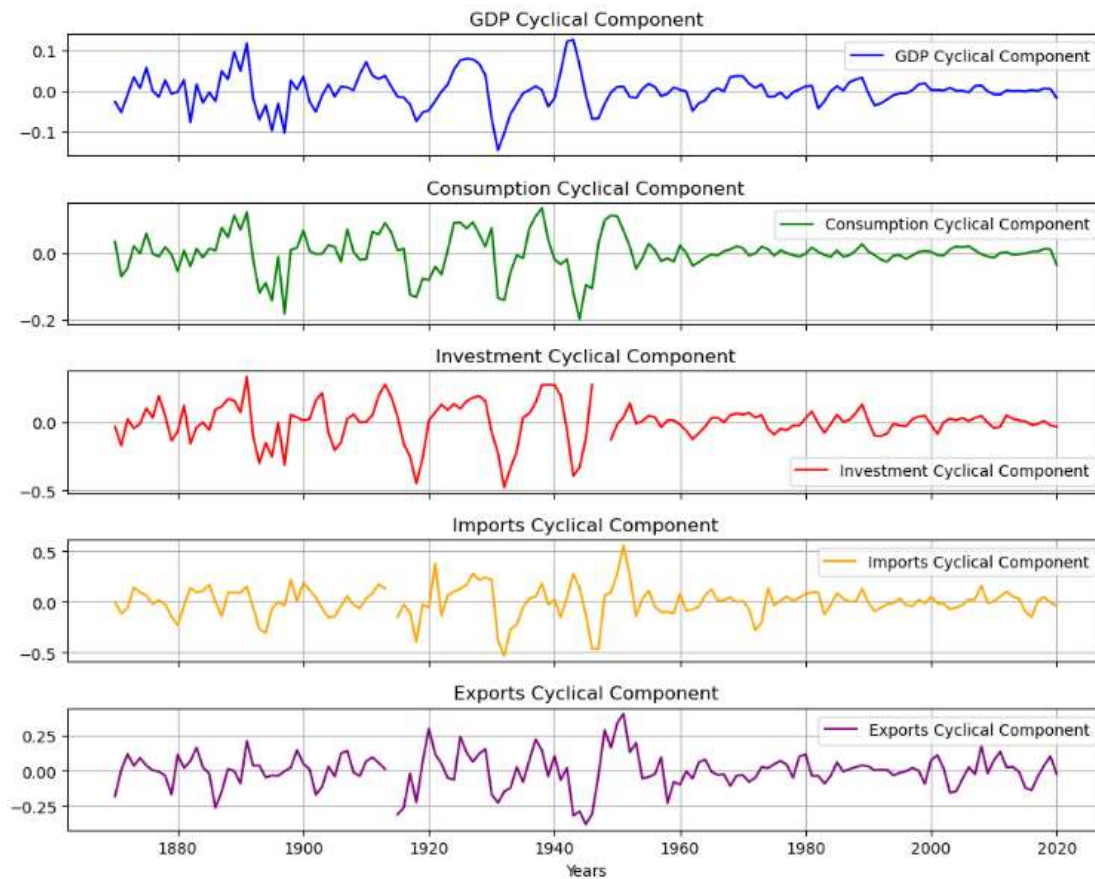
- GDP (yellow line): Shows steady growth over time, with significant acceleration after the 1950s, peaking around 2020.
- Consumption (blue line): Follows a similar trajectory to GDP, showing steady growth post-1950 with a close relationship to GDP, though slightly lower in magnitude.
- Investment (orange line): Shows more volatility and remains much lower than both GDP and consumption. There is a marked increase after 1950 but with notable fluctuations, especially a downturn after 2010.

Overall, the plot illustrates the historical growth of Australia's economy, with parallel trends in GDP and consumption, while investment remains more variable and lower in comparison.



These plots show the logarithm of three key macroeconomic indicators (GDP, Consumption, and Investment) compared to their trends over time, from 1870 to 2020. For the years 1947 and 1948 we have no data on investment. Therefore, we cannot compute the trend due to lack of data.

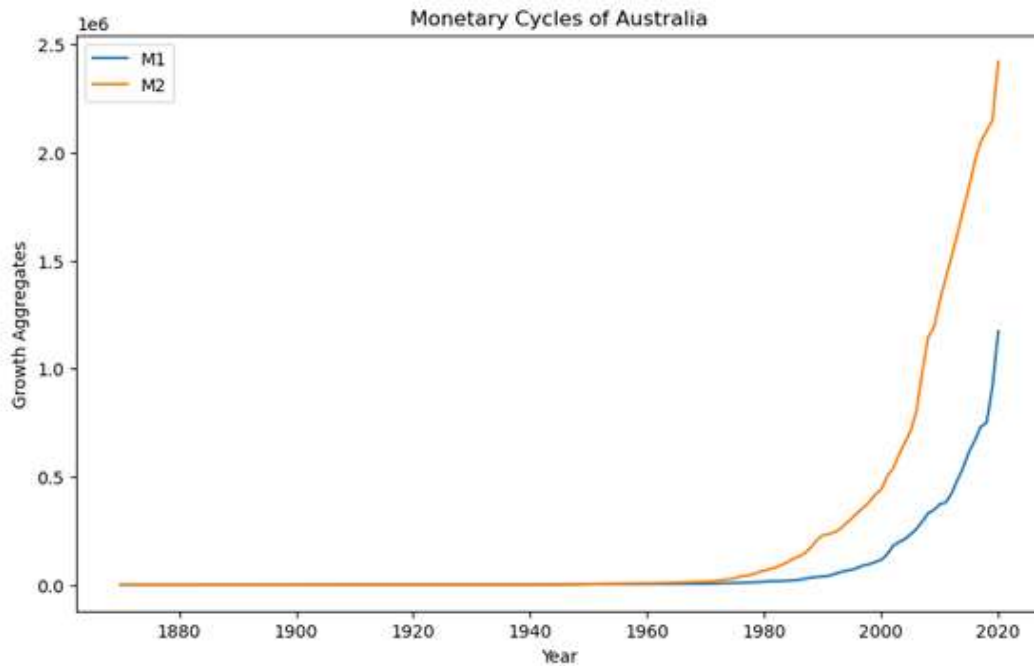
The logarithmic scale reveals the proportional growth rates and highlights periods of volatility in investment and consumption.



The above plots show the cyclical components of Australia's economy (GDP, Consumption, Investment, Imports and Exports) over time. More specifically, the **GDP** fluctuations reflect the cyclical nature of Australia's economy. There are periods of notable volatility, such as the Great Depression in the 1930s, the Banking Crisis (1890s) and World War II(1940), likely impacted Australia's GDP. The stability in later years may reflect the use of more effective economic policies that helped reduce extreme fluctuations. After the World War II, Australia's economy recovered quickly and boomed due to strong population growth, and increased demand for Australian exports. **Consumption** in Australia also exhibits cyclical behavior. The Great Depression resulted in reduced household incomes, widespread unemployment, and lower consumption. The post-World War II reflects prosperity, driven by higher wages and government spending on infrastructure. The **investment** component shows the highest volatility among the variables with sharp booms and dips(particularly in 1930). Both **imports** and **exports** are volatile and follow the same path. Imports are tied more to domestic demand, while exports are influenced by global demand. During global crisis (1930,1940), exports often fell more sharply than imports because of reduced global trade, whereas imports were partly sustained by domestic consumption needs. The common imports to Australia are consumer goods, intermediate goods and capital equipment and exports are iron ore, coal, LNG(Liquefied Natural Gas).

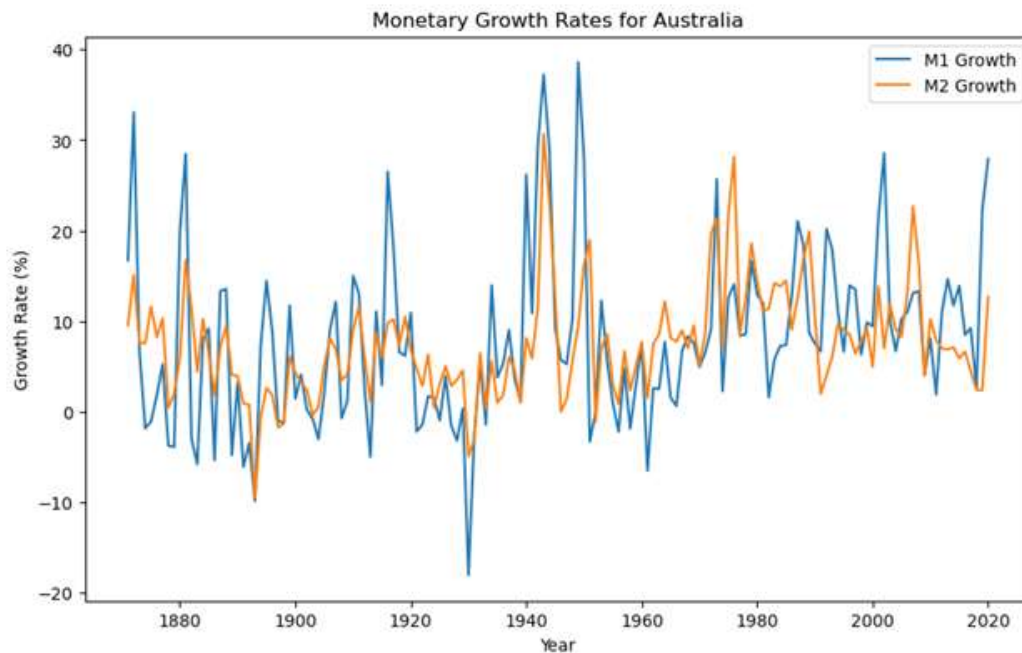
To compute the cyclical components for these variables we abstract the trend from the cycle. However, for the investment, imports and exports we couldn't compute the trend due to lack of data in some periods.

2) Monetary Cycles of Australia

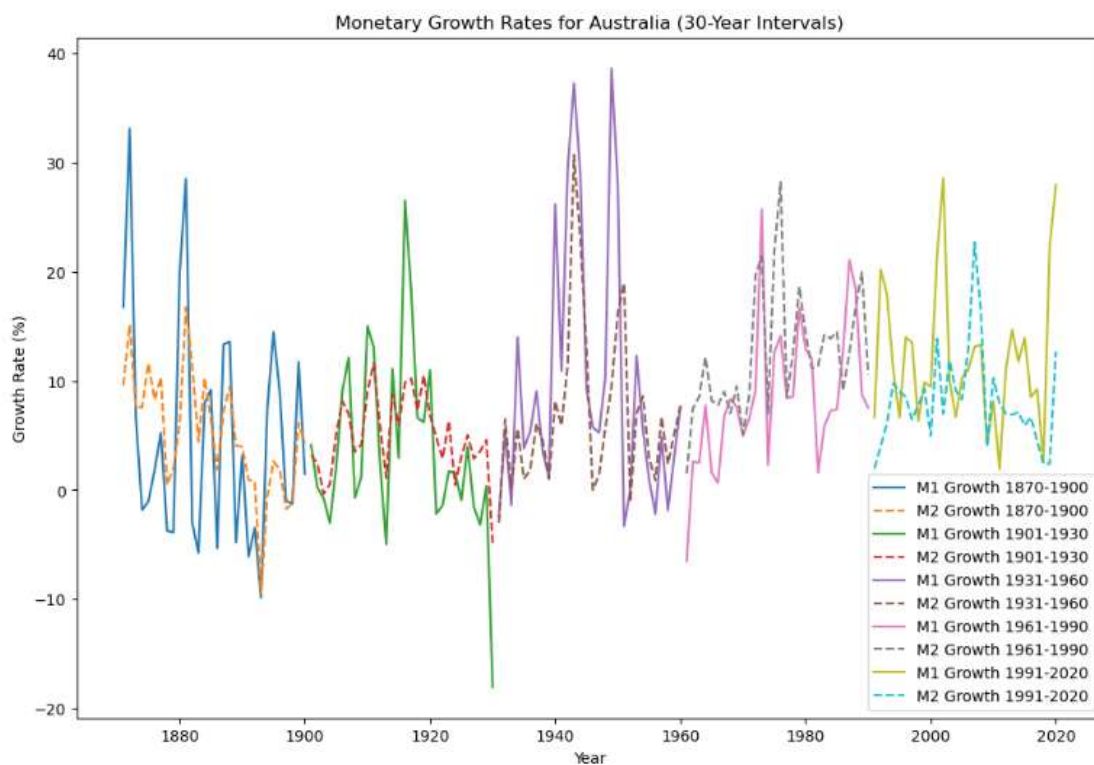


This plot shows the growth of monetary aggregates M1 (represents the most liquid forms of money) and M2 (includes all M1 plus other types of deposits) for Australia over time, from the 1870 to around 2020.

From the plot, both M1 and M2 remained relatively stable until around 1970. Afterward, particularly from around the 1970s and beyond, there is a sharp increase in both aggregates, with M2 growing more rapidly than M1, indicating the expansion of monetary supply in Australia.



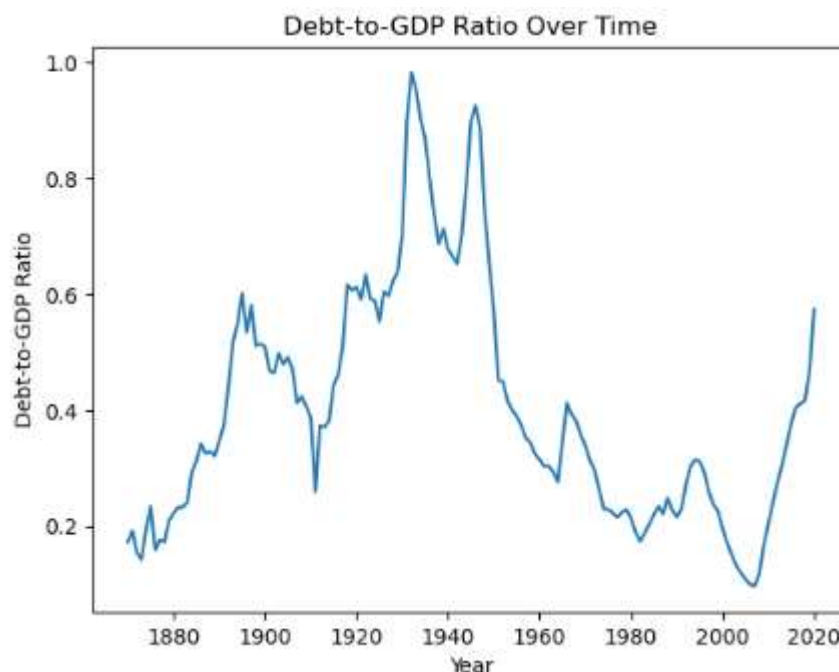
This plot shows the growth rates (%) of monetary aggregates M1 and M2 for Australia over time. These are noticeable periods of volatility, especially around major historical events like the Great Depression (1930s) and World War II (1940s), where growth rates increased sharply or dipped significantly. This plot provides insight into the changes in money supply growth over time and how they responded to economic conditions.



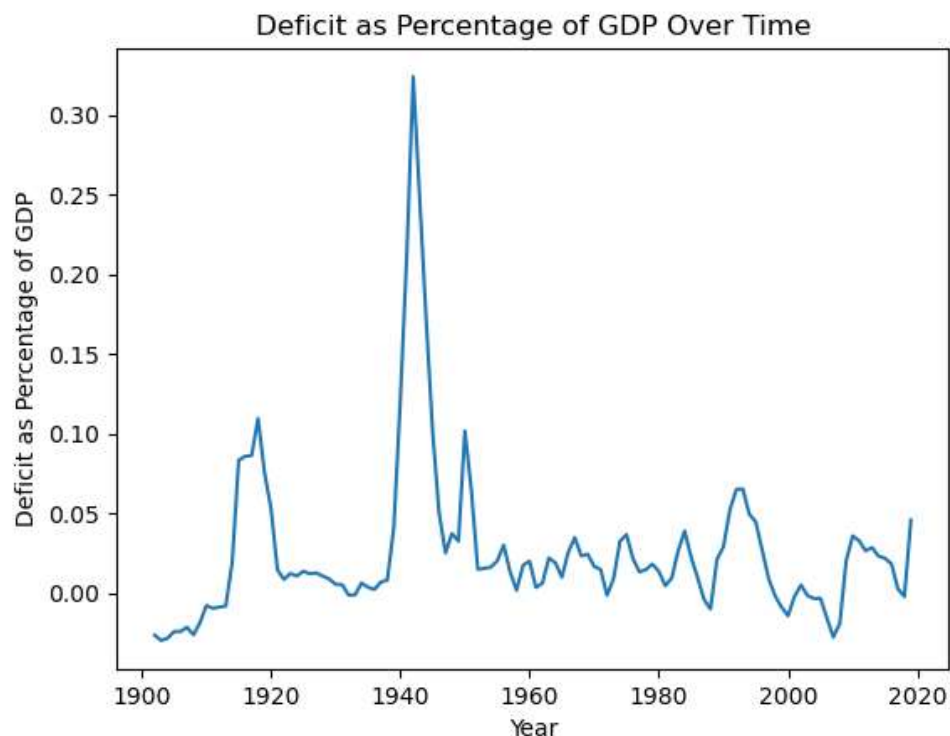
This plot displays the growth rates of narrow money (M1) and broad money (M2) in Australia across different 30-year periods from 1870 to 2020. By showing each interval separately, the plot highlights variations in the monetary growth rates over time.

- 1870-1900: This period was a time of both growth and instability for Australia's economy. The rapid growth was driven by the gold rush, agricultural expansion, and infrastructure development.
- 1901-1930: Between 1901 and 1930, Australia's economy transitioned significantly, driven by federation, industrial growth, and eventually the challenges of the Great Depression.
- 1931-1960: From 1931 to 1960, Australia's economy underwent significant transformation marked by recovery from the Great Depression, wartime economic mobilization, and post-war growth (World War II (1939-1945)).
- 1961-1990: From 1961 to 1990, Australia's economy experienced significant changes, characterized by economic reform, globalization, and periodic challenges (economic, cultural and social).
- 1991-2020: This period was marked by robust economic growth, adaptability to global shifts, and resilience in the face of challenges(COVID-19 pandemic(2020)), setting the stage for future developments.

3) Fiscal sustainability analysis of Australia



This plot shows the debt-to-GDP ratio for Australia over time, from 1870 to 2020. The debt-to-GDP ratio represents the proportion of the country's national debt compared to its GDP. The ratio shows significant peaks around the World Wars (1910s and 1940s), indicating high levels of debt relative to the economy during those periods. After World War II, the ratio declines steadily until around the 1970s, after which it remains relatively low but fluctuates. In the most recent period (post-2000), there is a noticeable increase in debt-to-GDP ratio, indicating rising public debt levels relative to GDP.



This plot represents the evolution of Australia's deficit as a percentage of GDP from 1900 to 2020, calculated as the difference between expenditure and government revenue. A positive value indicates a surplus, while a negative value indicates a deficit. During the World War I (1914-1918), there is a noticeable rise in the deficit, reflecting increased government spending to finance the war effort. Furthermore, a dramatic spike in the deficit is observed in World War II (1939-1945), peaking above 30% of GDP. This reflects extensive government borrowing to support wartime activities. The deficit sharply declines after the war (Post-War Era (1946-1970)), transitioning into periods of smaller deficits or balanced budgets as the economy recovers and wartime expenses subside. Finally, there are visible increases in the deficit during periods of economic downturns, such as the Global Financial Crisis (2008-2009), followed by reductions during recovery. The upward movement near 2020 likely corresponds to fiscal responses to the COVID-19 pandemic.

Interpretation of Z_t

$$Z_t = \frac{1 + r_t}{(1 + \pi_t)(1 + \gamma_t)}$$

1. **Nominal Interest Rate (r_t):** Represents the cost of borrowing or the return on debt in nominal terms.

2. **Inflation Rate (π_t)**: Measures the rate at which prices are increasing, impacting the real value of debt.

3. **GDP Growth Rate (y_t)**: Reflects the rate at which the economy is expanding, influencing the capacity to sustain debt.

The numerator $(1+r_t)$ represents the growth rate of debt, while the denominator $(1+\pi_t)(1+y_t)$ represents the growth rate of nominal income.

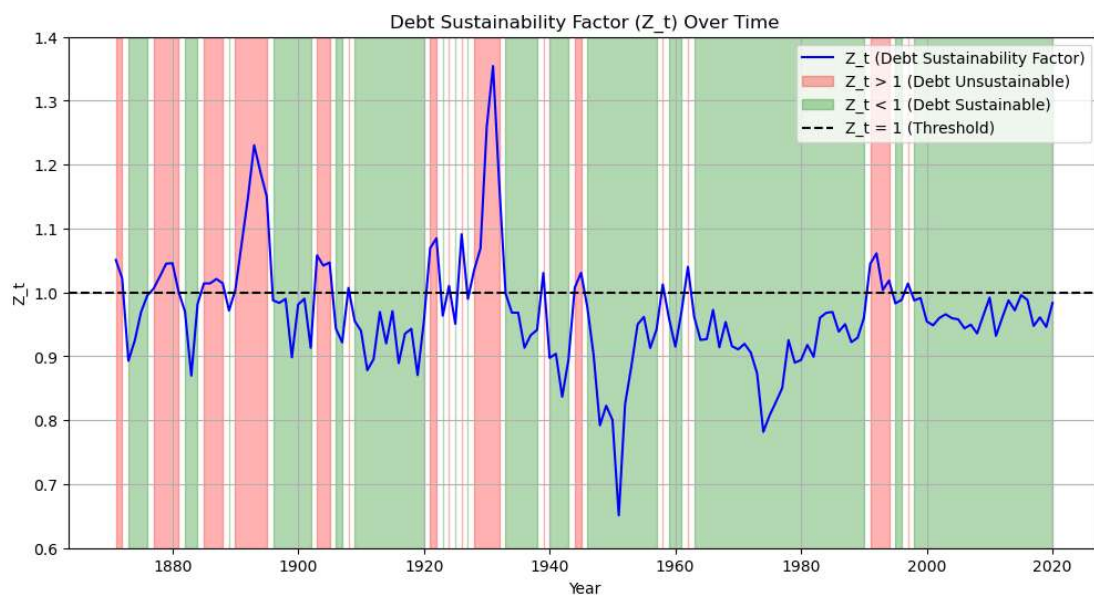
Role of Z_t :

- **$Z_t > 1$** : Indicates that debt grows faster than the economy's capacity to manage it, potentially leading to unsustainable public debt dynamics.

- **$Z_t < 1$** : Implies that economic growth and inflation outpace the growth of debt, stabilizing or reducing the debt-to-GDP ratio.

It serves as a critical measure in assessing fiscal sustainability by determining whether the growth in public debt aligns with the economy's ability to support it.

How public debt evolves with sub-periods of Z_t ?



The above plot indicates how the public debt evolves over time. We computed the public debt using the formula
$$Z_t = \frac{1 + r_t}{(1 + \pi_t)(1 + y_t)}$$
.

In the plot the **red shaded areas** indicate when $Z_t > 1$, suggesting times when debt growth outpaced the economic capacity to sustain it, making debt unsustainable (increasing public debt), while the **green shaded areas** indicate periods when $Z_t < 1$, showing times when economic growth and inflation outpaced debt growth, which helped to stabilize or reduce

debt relative to GDP (decreasing public dept). For example, a sharp boom is noticeable in 1930 during the Great Depression, and a sharp dip occurs in 1945 due to World War II.