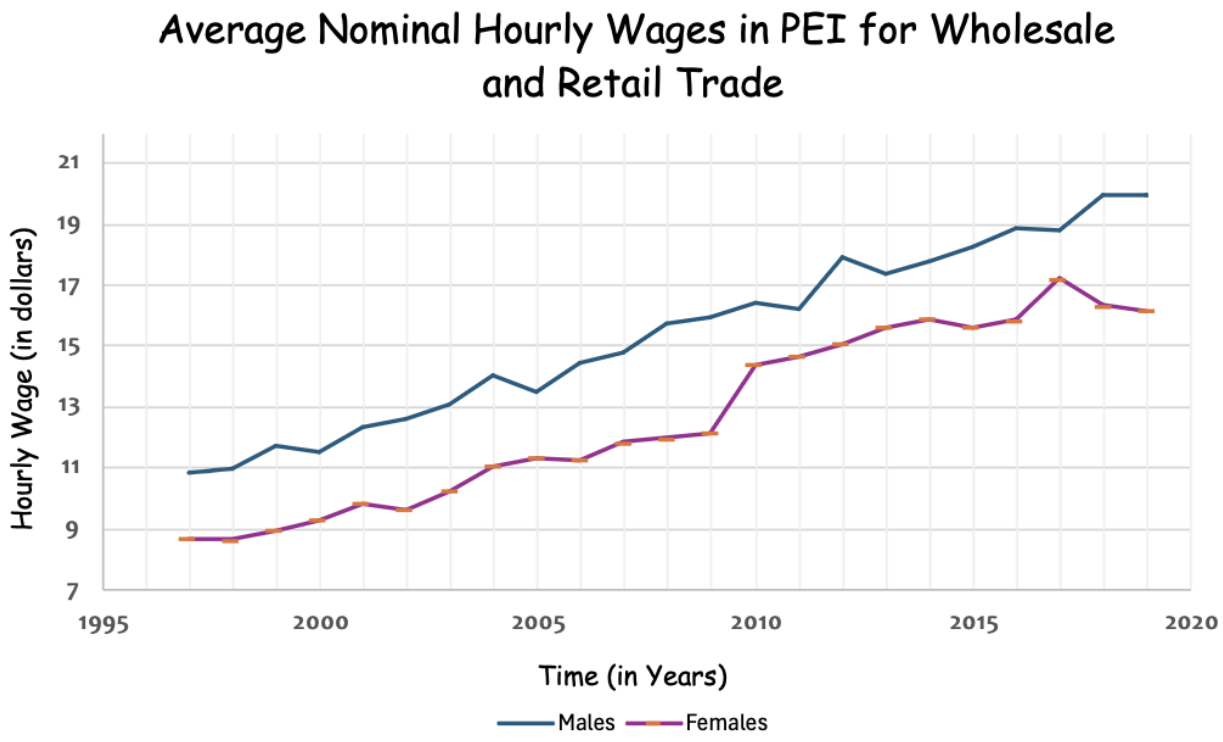
Part A: The Cost of Living

For this part, use the file WageXYZ.csv, where XYZ is the number that is assigned to you by the Quiz on Learn. The file contains annual series of average nominal hourly wages for males and females in a particular province and industry expressed in dollars per hour. The specific province and industry for your dataset is described in the WageDescriptions.csv file. Look for the row associated by your assigned number. The file also contains the annual series of the consumer price index base 100 = 2002 in that province (Statistics Canada, 2020).

WageDescriptions.csv file
Province: PEI
Job TypeL Wholesale and Retail Trade

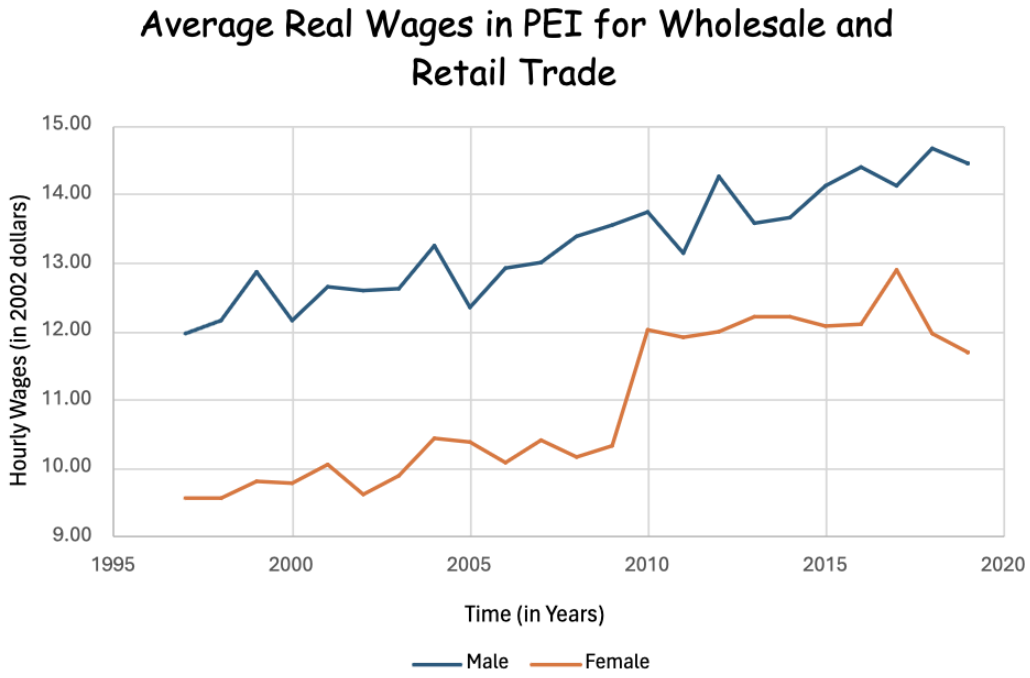
1. **Plot the evolution of the hourly nominal wage for males and females on the same chart. Interpret what you see: what kind of trending behavior, is there a difference between males and females in terms of trends or fluctuations, etc.**



Overall, both male and female series have a similar positive trend with the male wage starting slightly below $11 in 1997 and increasing to around $20 by 2019. In contrast, the female wage begins around a little below $9 in 1997 and rises to approximately $16 by 2019. Males' growth rates fluctuate over time, experiencing periods of positive growth interspersed with slight declines or stagnant phases. Notably, there is a significant increase in the growth rate around 2011-2013, followed by a slight dip before gradually increasing again. On the other hand,

females' growth rates also exhibit fluctuations but generally maintain a more consistent upward trend compared to males. There are notable spikes in growth rate around 2009-2010 and 2017, indicating periods of rapid growth compared to other years. These spikes could be attributed to movements advocating for income equality between women and men. However, there was a slight dip in growth rate from 2017, although overall, females exhibited a faster growth rate compared to the steady rate seen in males. Despite these trends, income inequality persists as men continue to earn more. Female growth rates show a bit more volatility with slightly larger fluctuations compared to males. Overall there is an upward trending behavior in both male and female wages over time.

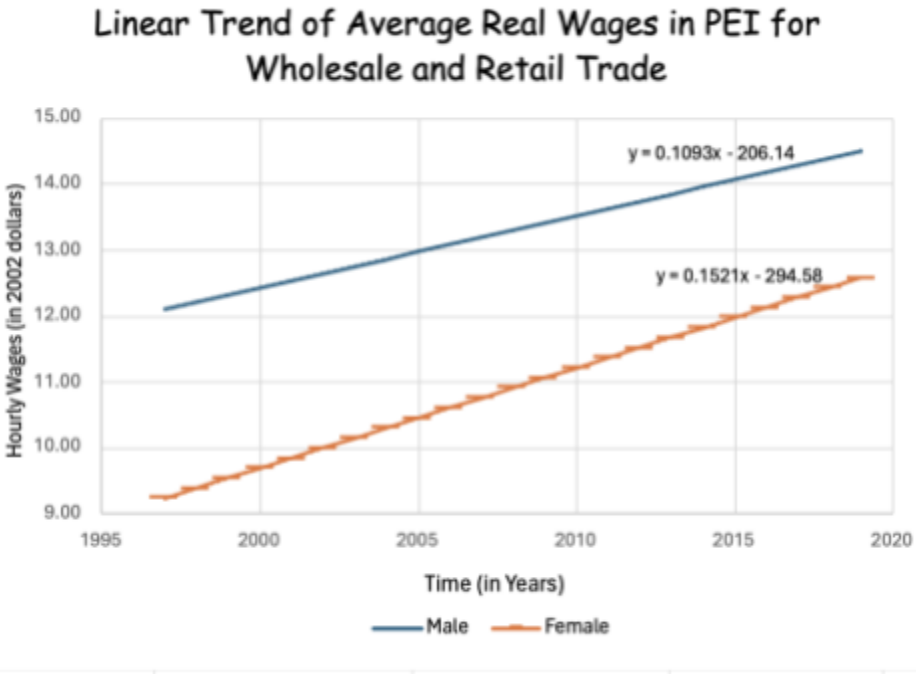
2. **Plot the evolution of hourly real wage in dollars of 2002 for males and females on the same chart. Interpret what you see and compare this chart with the one you obtained in the previous question. Which chart between this one and the one produced in the previous question provides a better picture of the evolution of the standard of living of individuals working in that industry? Explain.**



The graph illustrates a narrowing gap in real per hour wages between males and females around 2010, indicating a reduction in wage disparity over time. Male hourly wages show steady growth with minor fluctuations around 1999, 2004, and 2012. In contrast, female wages experienced a significant increase around 2012, jumping from approximately $10 to $12, followed by moderate growth with minor fluctuations and slight variations. In 1997, female real per hour wages were slightly above $9, while male wages were around $12, reflecting a $3 difference. However, over time, this gap decreased, with females earning around $12 and males

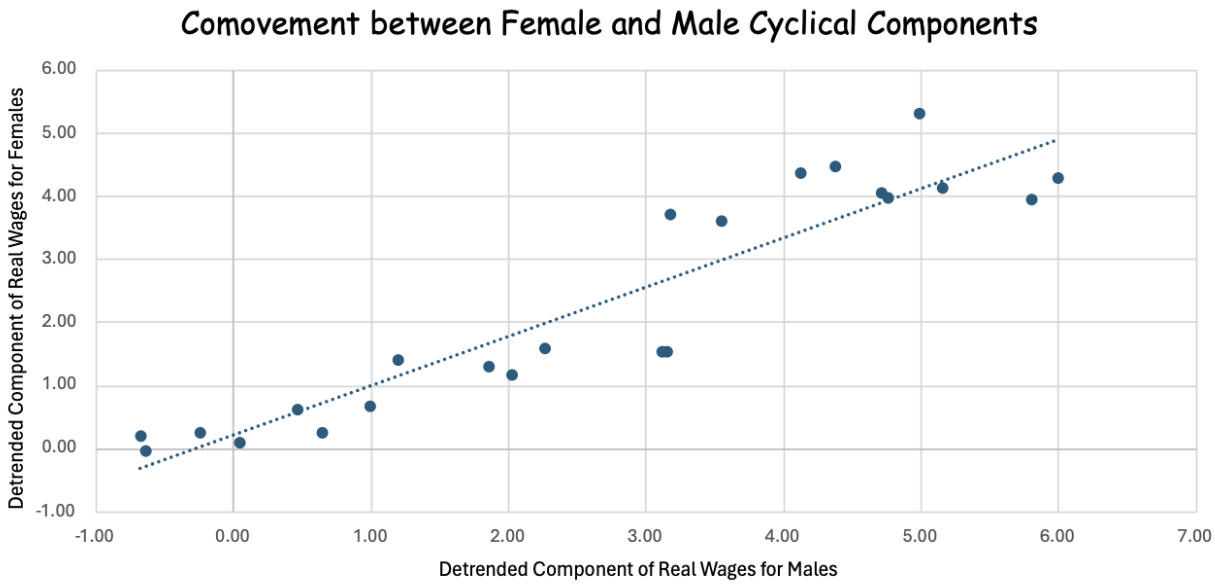
around $13 by 2010, indicating a $1 difference. This shift signifies a positive stride towards achieving greater gender wage equality, although recent years post-2017 show a resurgence in the divergence. The second chart, focusing on real per hour wages, provides a more comprehensive insight into the standard of living evolution among individuals in the Wholesale and Retail Trade sector. This is crucial because nominal variables only consider current prices, failing to capture the actual changes in wage levels for males and females accurately.

3. **Fit a linear trend to both real wage series and plot the two trends on the same graph. Interpret what you see: is the wage gap changing on average? What is the annual change on average over that period for males and females? Discuss (Hint: To answer the question, you can look at the coefficient of time of the trend equations).**



The above graph depicts a linear trend in Real Per Hour Wages within the Wholesale and Retail Trade sector in PEI. Notably, the wage gap is gradually narrowing over time, suggesting a convergence in wages between males and females. The slope of the linear trend for female real wages appears slightly steeper than that of male real wages, indicating a faster rate of increase in female wages within the industry. Specifically, the linear trend equation for males is 0.1093x - 206.14, while for females it is y = 0.1521x - 294.58. This translates to an annual change, as determined by the coefficients, of approximately $0.11 for males and $0.15 for ex females. Consequently, on average, female wages are increasing by around 4 cents more per year compared to male wages in the Wholesale and Retail Trade industry. In summary, these coefficients provide valuable insights into the trend and magnitude of wage changes, highlighting the slightly higher rate of increase in female wages within the specified period by 4 cents on average compared to male.

4. **Detrend the real wage series using the linear trends computed in the previous question. Since the series are annual, the detrended series are the cyclical components. Using a scatter plot, analyze the comovement between the two cyclical components. Try to explain your results: e.g. why there is a positive, negative or no comovement between the two variables?**



Positive comovement, shown by a strong positive correlation between detrended male and female series, indicates that these variables move together over time. This suggests that the cyclical fluctuations in male and female detrended values are closely aligned so as male wages rise, so do female wages overall. This can be attributed to several factors like economic conditions such as growth or recession, leading to synchronized movements in their detrended values during economic cycles or policy impacts where Government policies like regulatory changes affect male and female economic activities in the same way. Other factors include social and demographic factors where shifts in societal norms, demographic structures, and family dynamics influence labor force participation and incomes for both genders, influencing their detrended values to align positively over time.

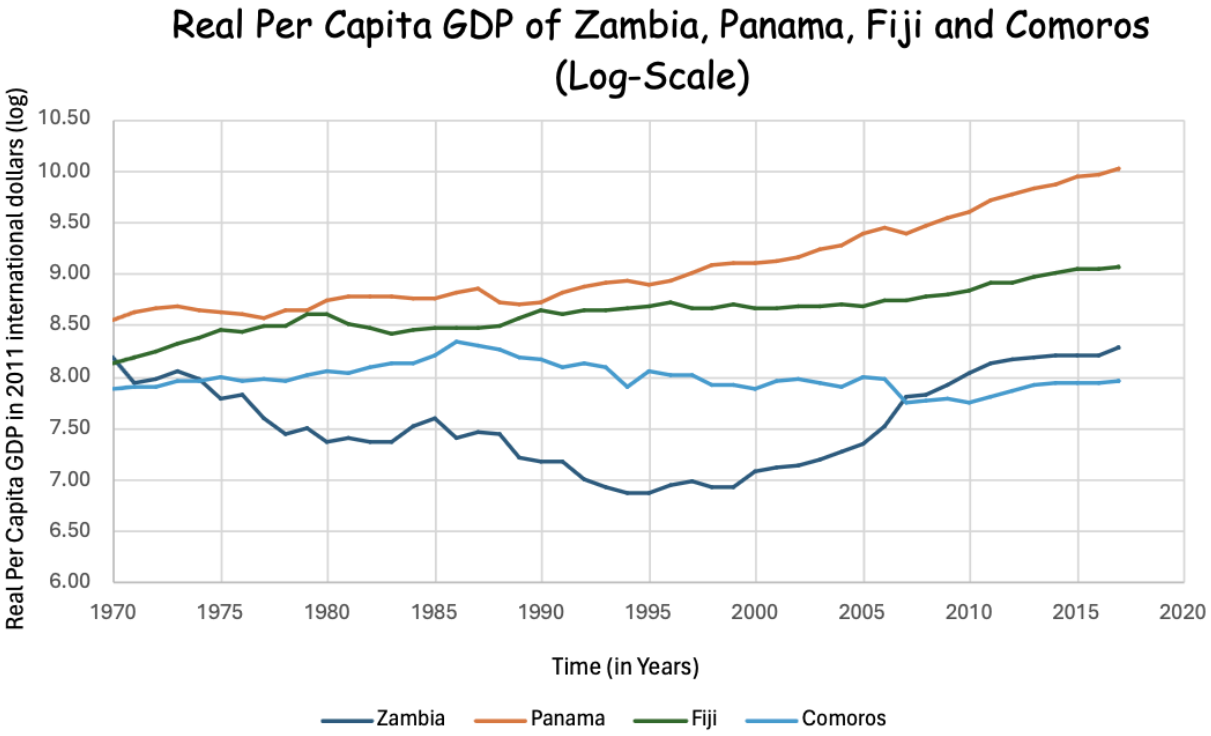
Part B: Business Cycle, Growth and Inequality

For this part, use the file RealGDP.csv. The file contains an annual series of real per capita GDP for 152 countries from 1970 to 2017 expressed in international dollars of 2011 (Feenstra et al., 2015). Each student has to analyze four different countries. Your four countries are the ones on the row of the file assignedCountries.csv where the value in the assigned number column is equal to XYZ, where XYZ is the same number used in Part A. On the same row, you will also find the assigned years for questions 5 and 6.

1. **What are the complete names of the four countries that are represented by the three-letter codes? In the following questions, refer to the countries by their full names, not by their codes.**

   ZMB - Zambia
   PAN - Panama
   FJI - Fiji
   COM - Comoros

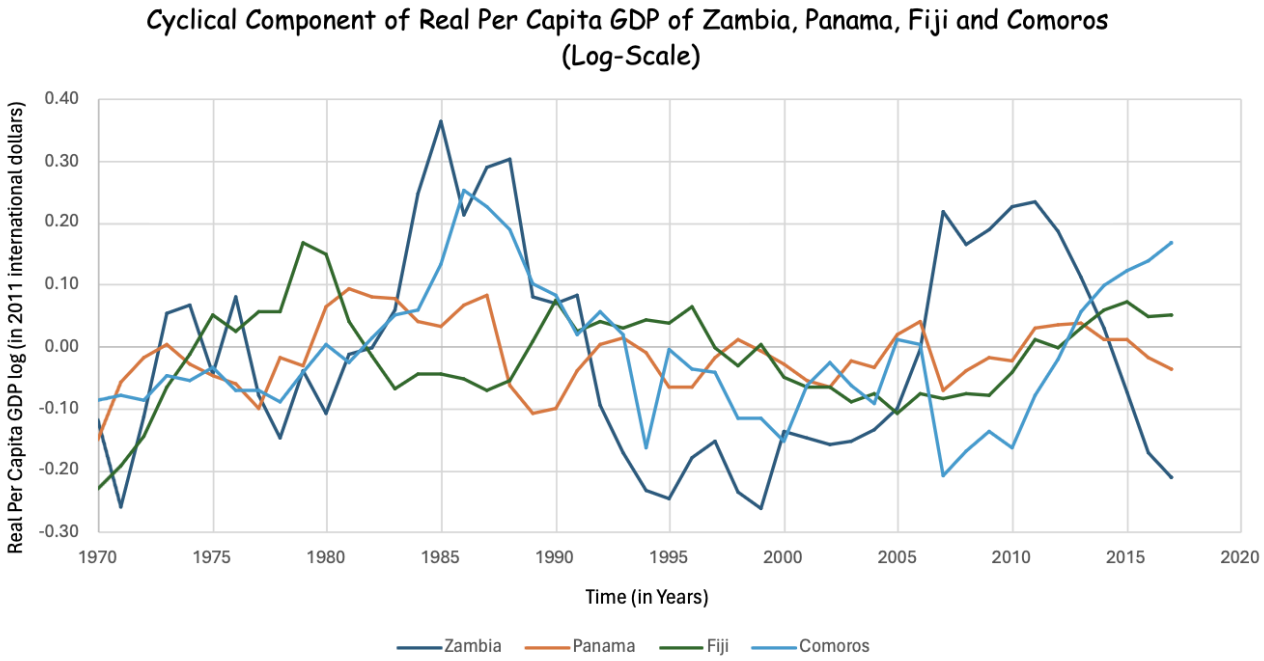
2. **Plot the evolution of the real per capita GDP of the four countries on the same chart using the log-scale. Describe the differences and similarities that you observe.**



The graph illustrates the Real per capita GDP trends of Comoros, Zambia, Panama, and Fiji over several decades. Around the years 1970-1975 and 2006, Comoros and Zambia exhibited a pattern of overlapping GDP values. However, post-1975, Comoros consistently maintains a higher real per capita GDP than Zambia until around 2006 when both countries' GDP aligns, after which Zambia demonstrates higher growth compared to Comoros. In contrast, Panama and Fiji consistently maintain higher GDP values compared to Comoros and Zambia, with Panama generally exhibiting superior GDP levels throughout the period. Zambia and Comoros show more fluctuating GDP patterns, particularly with Zambia experiencing a decline in GDP from 1985 to 1995 followed by a gradual increase, resulting in a relatively stable yet lower overall GDP trend. Panama, on the other hand, demonstrates a steady upward trajectory, starting from approximately 8.5 in 1970 and reaching around 10 in 2017. Fiji also follows a

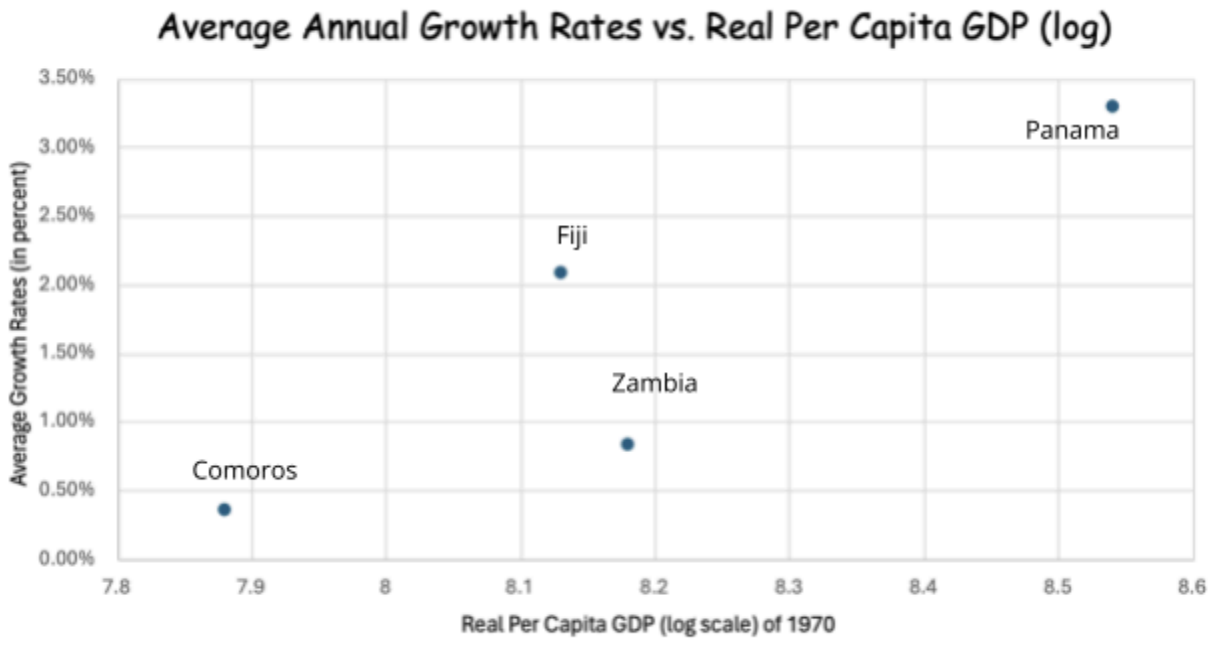
similar upward trend, beginning just below 8 in 1970 and climbing to around 9 in 2017. The 4 countries were closest in real GDP values around 1975 and furthest apart around the 2000s. Overall, by looking at the graph, Fiji, Panama and Zambia show growth in 2015 compared to the 1970s, while Comoros exhibits a decline in their real GDP.

3. **Compute the cyclical component of each series expressed in logs using a quadratic trend, and plot them on either 4 different line charts or on the same one. The choice is yours and it depends on which option provides a clearer approach to compare the cycles. Discuss what you see by answering the following questions:**
    - **Do you observe a positive, negative or no comovement between the different business cycles?**
    - **If you observe no comovement between two business cycles, can it be explained by the two countries being poor trading partners? You may have to search the internet to answer that question.**
    - **If you observe a strong positive comovement between two business cycles, can it be explained by the two countries being strong trading partners? You may also have to search the internet to answer that question.**
    - **Do you observe common periods of recession? Are they world wide recessions? You may also have to search the internet to answer that question.**
      Hint: Cyclical components of annual time series are simply the detrended series.



Positive comovement is observed between Panama and Fiji, as well as between Fiji and Comoros, particularly evident in the later years from 2000 to 2017, with detrended values moving in the same direction. Conversely, no significant comovement is noted between Zambia and the other countries or between Panama and Zambia. This lack of comovement between Zambia and the others may be attributed to limited economic interactions or differing economic structures. Strong trading partnerships potentially explain the positive comovement between Panama and Fiji, as well as between Fiji and Comoros, leading to correlated economic activities and business cycles. Notable recessionary periods are identified in the detrended data for all countries around the early 1980s, mid-1990s, and the global financial crisis of 2007-2008, aligning with worldwide recessions.

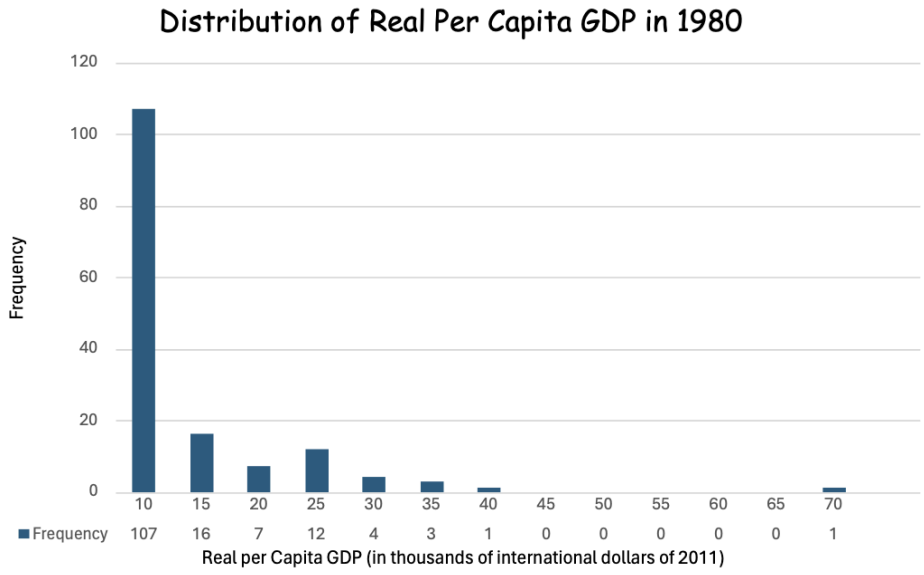
4. **Compute the average annual growth rate between 1970 and 2017 for all four countries. Then, produce a scatter plot with the 1970 real per capita GDP expressed in logs on the x-axis and the average growth rates on the y-axis (you should have four points). Discuss the results by answering the following questions:**
    - **Are the four countries converging to each other?**
    - **Using countries' characteristics such as the level of education, life expectancy, economic freedom, etc., try to justify why some are converging and why some are not. You can use that data files from the module on Growth and Development or get the information from a reliable internet source (like the World Bank).**

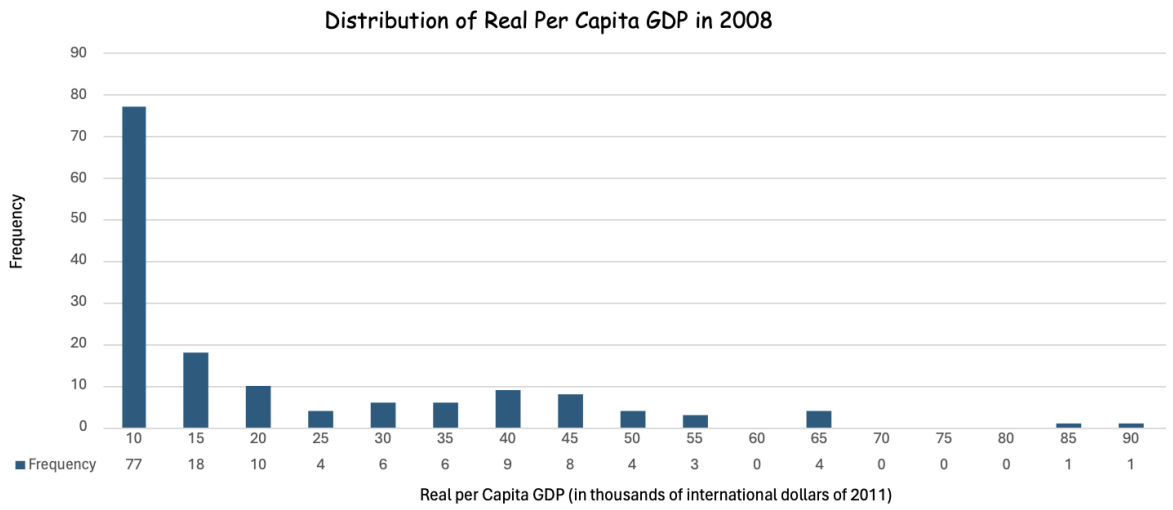


Panama has the highest growth rate at 3.30%, followed by Fiji at 2.09% and Zambia at 0.84%, while Comoros has the lowest growth rate at 0.36%. This trend aligns with the characteristics analysis, where factors like education, life expectancy and economic freedom play significant roles. Panama and Fiji, with their higher levels of education (Panama's literacy rate of 94.1% and Fiji's primary education enrollment rate of over 95%), better healthcare systems (Panama's life expectancy of 78.9 years and Fiji's life expectancy of 67.4 years), and greater economic freedom (Panama ranks 66th in the Economic Freedom Index), are likely moving towards higher real per capita GDP levels, indicating convergence. In contrast, Zambia (with a literacy rate of 63.4% and life expectancy of 57.5 years) and Comoros (with a literacy rate of 56.5% and life expectancy of 63.4 years) face challenges such as lower education levels, healthcare issues, limited economic freedom (Zambia ranks 148th and Comoros ranks 150th in the Economic Freedom Index), leading to potential divergence or slower convergence.

Years Given: 1980 and 2008

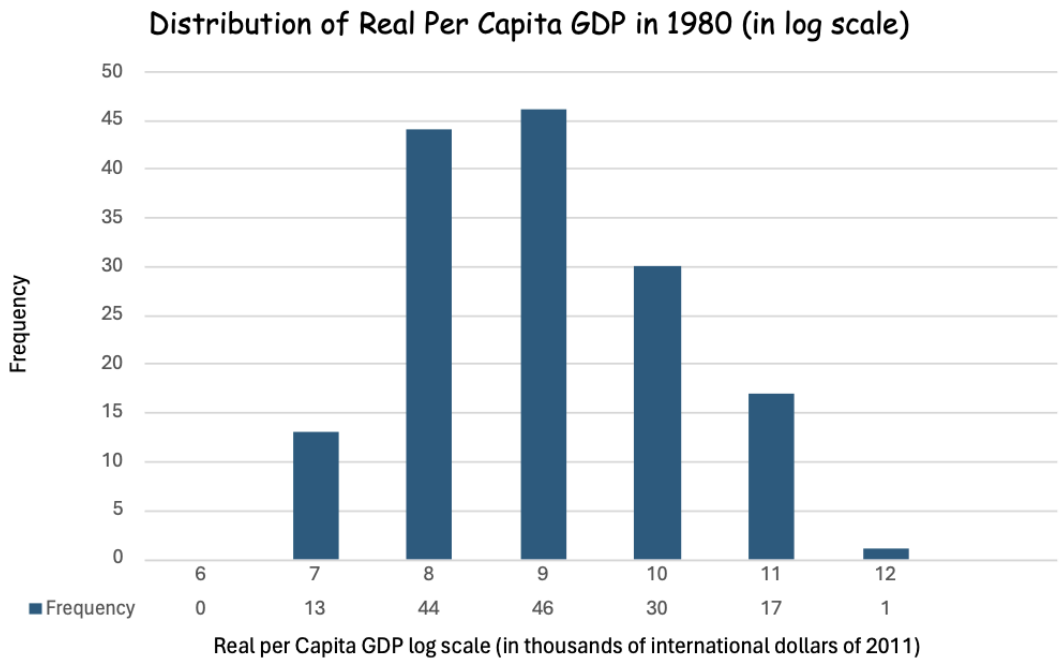
5. **For this question, you have to compare the distribution of real per capita GDP across all 152 countries in the two assigned years expressed in thousands of international dollars of 2011 (the choice of units is to make the x-axis labels more readable). Create two histograms (with the option breaks=25), one for each year and interpret what you see. Do you see a difference in terms of inequality? Do you see a change in the proportion of poor countries?**

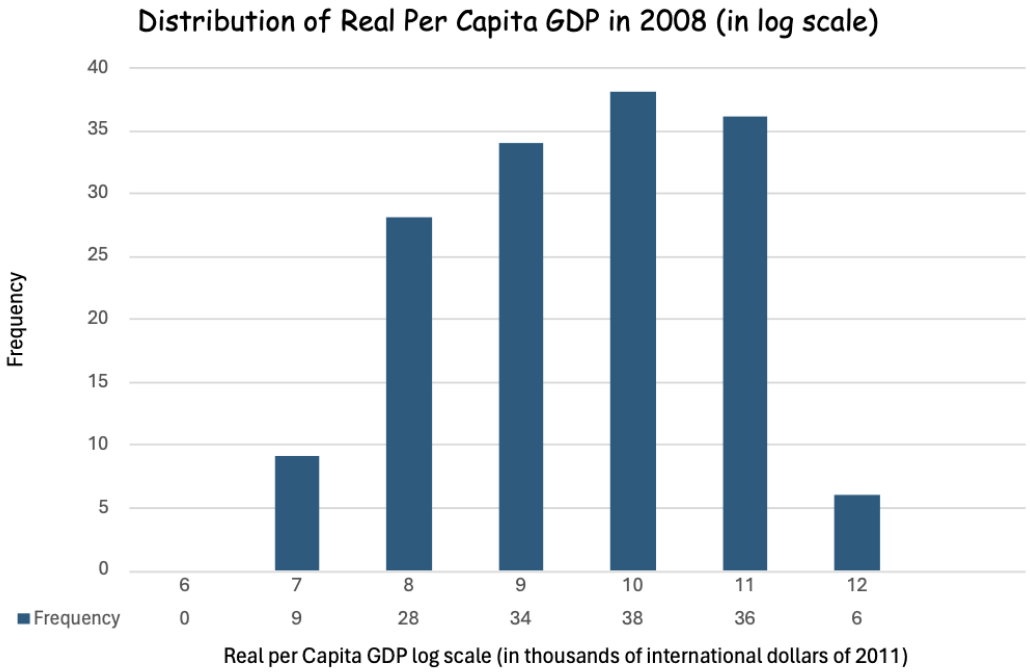




In 1980, there was a higher frequency of countries with lower GDP values in bins 10 to 30, suggesting greater income disparity. However, by 2008, the distribution became more even across bins, with noticeable increases in frequencies in bins 35 to 45, indicating a potential reduction in inequality as more countries moved towards moderate GDP values. Regarding the proportion of poor countries, the analysis focuses on frequencies in lower GDP bins (e.g., bins 10 to 30). In 1980, there were more countries with lower GDP values, reflecting a higher proportion of poorer countries. In contrast, 2008 showed a shift with increased frequencies in bins 35 to 45, suggesting a change in the proportion of poor countries with potential economic growth in some nations. Overall, there is a shift towards a more even distribution of GDP values across countries in 2008 compared to 1980, indicating a potential reduction in inequality. As well, there appears to be a change in the proportion of poor countries, with a potential increase in countries with moderate GDP values (bins 35 to 45) in 2008 compared to 1980, possibly indicating economic growth in some countries.

6. **For this question, you have to compare the distribution of real per capita GDP across all 152 countries in the two assigned years of expressed logs. Create two histograms (with the option breaks=25), one for each year and interpret what you see. Do you see a difference in terms of inequality? Do you see a change in the proportion of poor countries? Also, explain why the histograms are different when the real per capita GDP's are expressed in logs.**





In terms of inequality, the spread of GDP values across bins indicates higher inequality with wider spreads and higher frequencies in lower bins. Specifically, in 1980, there were higher frequencies in lower bins (e.g., bins 8 to 10), suggesting greater income disparity, while in 2008, frequencies were slightly higher in higher bins, indicating a potential reduction in inequality. Regarding the proportion of poor countries, frequencies in lower GDP bins (e.g., bins 7 to 10) in 1980 indicate a higher proportion of poor countries, while in 2008, frequencies in higher bins

suggest a potential decrease in the proportion of poor countries or economic growth. Additionally, the use of log-scale compresses data, especially at higher values, leading to a less skewed distribution while making small differences less apparent and allowing for easier visualization of changes in trends between the years. Overall, the data and log-scale GDP analysis suggest potential trends of reduced inequality and changes in the proportion of poor countries from 1980 to 2008.