Homework 11 (60 Points)

Note. This homework needs to be written in `R Markdown` and submitted in `pdf` format.

Part I

Problem 1 (8 Points)

1. In one graph, plot the annual nominal GDP of the U.S., China, Germany, Japan, and Korea from 1970 to 2020[1]. (2 Points)

2. In one graph, plot the annual real GDP *per capita*[2] of the U.S., China, Germany, Japan, and Korea from 1970 to 2020[3]. (2 Points)

3. Construct a real GDP *per capita* index that is equal to 1 for all countries in 1970. To do this, divide each series by its 1970 value[4]. In one graph, plot all the series together. Which country has grown the most percentage-wise since 1970? Which country has seen the second largest growth? (4 Points)

Problem 2 (2 Points)

In one graph, plot the annual nominal GDP, GNP, National Income (NI), Personal Income (PI), and Disposable Personal Income (DPI) of the U.S. from 1970 to 2020.

[1] For this problem, note that the GDP of China, Germany, Japan, and Korea are in dollars, while the GDP of the U.S. is in billions of dollars. Let us turn all of them into billions of dollars. This means dividing the data for China, Germany, Japan, and Korea by 1 billion (10^9).

[2] GDP *per capita* = GDP/Population.

[3] Note that all data series are expressed in 2010 U.S, dollars here.

[4] i.e., divide each year's real GDP *per capita* by 1970's real GDP per capita

Problem 3 (9 Points)

In this problem we look at the value-added of different U.S. sectors. To do so, download the quarterly real value-added of the U.S. Manufacturing, Construction, Retail, Finance, and Healthcare sector from 2005.Q1 to 2020.Q4[5].

1. Construct an index for each sector so that 2005.Q1 = 1[6]. In one graph, plot all the series together. (2 Points)

2. Describe what you observe from the data. During the recession caused by the 2008 financial crisis, which sector started to decline first? Which sector experienced the most precipitous decline during the financial crisis? Which sector recovered most quickly? Which sector did not seem to be negatively affected by the crisis? Which sector *still* hasn't recovered to its pre-crisis level? (5 Points)

3. During the recession caused by Covid-19, which sector declined the most? Which sector was least affected? (2 Points)

Problem 4 (7 Points)

In this problem we look at three components of GDP – Consumption (C), Investment (I), and Government Spending (G). Download the quarterly data on U.S. real consumption, real investment, and real government spending from 2003.Q1 to 2020.Q4.

1. Construct an index for each component so that 2003.Q1 = 1. In one graph, plot all the series together. (2 Points)

2. Describe what you observe from the data. During the recession caused by the 2008 financial crisis, which component of GDP started to decline first? Which component declined the most during the financial crisis? Which component actually *increased* during the financial crisis? (3 Points)

3. During the recession caused by Covid-19, which component declined the most? Which component was least affected? (2 Points)

[5]Note: in FRED, the date for Q1 is 01-Jan. The date for Q2 is 01-Apr. The date for Q3 is 01-Jul. The date for Q4 is 01-Oct.

[6]To do this, divide each series by its 2005Q1 value.

Problem 5 (6 Points)

In this problem we look at the Consumption (C), also called the Personal Consumption Expenditure (PCE), component of GDP. Consumption can be further divided into three components: consumption on durable goods, consumption on nondurable goods, and consumption on services. Download the quarterly data on U.S. real durable goods consumption, real nondurable goods consumption, and real service consumption from 2003.Q1 to 2020.Q4.

1. Construct an index for each component of consumption so that 2003.Q1 = 1. In one graph, plot all the series together. (2 Points)

2. Describe what you observe from the data. During the recession caused by the 2008 financial crisis, consumption on which component dropped the most? Which component was least affected? After the recession, which component of consumption has been growing the fastest? (3 Points)

3. During the recession caused by Covid-19, consumption on which component dropped the most? (1 Points)

Problem 6 (8 Points)

In this problem we look at the Investment (I) component of GDP. Investment can be further divided into business fixed investment, residential investment, and additions to inventory. For this problem, download the quarterly data on U.S. real business fixed investment and real residential investment from 2003.Q1 to 2020.Q4.

1. Construct an index for each component so that 2003.Q1 = 1. In one graph, plot both series together. (2 Points)

2. Describe what you observe from the data. Before and during the 2008 financial crisis, when did residential investment start to decline? When did business fixed investment start to decline? When did residential investment start to recover and when did business fixed investment start to recover? (4 Points)

3. During the recession caused by Covid-19, investment on which component dropped the most? (2 Point)

Part II

Problem 1 (6 Points)

In this problem, we look at the nominal and real GDP of the U.S. First, download the data for quarterly nominal GDP and quarterly real GDP of the U.S. from 1950.Q1 to 2020.Q4.

1. What is the base year for the real GDP data? (2 Points)
2. In one graph, plot the annual nominal GDP and annual real GDP from 1950 to 2020. (2 Points)
3. Make a bar plot of the annual GDP growth rates from 1951 to 2020. (2 Points)

Problem 2 (4 Points)

Download the monthly CPI of China and Japan from Jan. 2000 to Dec. 2020.

1. Calculate year-on-year inflation rates[7] based on the Chinese and Japanese CPI. In one graph, plot the Chinese and the Japanese inflation rates from Jan. 2001 to Dec. 2020. (2 Points)
2. During this period of time, how many months did Japan experience deflation? (2 Points)

[7] Given monthly price indices $\{\mathcal{P}_t\}$, the year-on-year inflation rate is

$$\pi_t = \left(\frac{\mathcal{P}_t}{\mathcal{P}_{t-12}} - 1\right) \times 100\%$$

Problem 3 (6 Points)

Download the monthly U.S. CPI-U, C-CPI-U, and PCEPI from Jan. 2000 to Dec. 2020.

1. In one graph, plot all the price indices together. Note that different indices have different base periods. Let us change that by making Jan. 2000 the common base period for CPI-U, C-CPI-U, and PCEPI. To do this, divide each series by its Jan. 2000 value and then times 100, so that the Jan. 2000 value for all these series are equal to 100. (2 Points)

Now download the monthly CPI-U less food and energy and PCEPI less food and energy from Jan. 2000 to Dec. 2020.

2. Calculate year-on-year inflation rates based on each index. In one graph, plot the CPI-U inflation rate, the C-CPI-U inflation rate, the PCEPI inflation rate, the core CPI-U inflation rate, and the core PCEPI inflation rate from Jan. 2001 to Dec. 2020. (2 Points)

3. During this period of time, headline inflation rate as measured by which index – CPI-U, C-CPI-U, or PCEPI – tend to be the highest? Core inflation rate as measured by which index – core CPI-U or core PCEPI – tend to be higher? (2 Points)

Problem 4 (4 Points)

The Producer Price Index (PPI) comes in different flavors. One can look at PPI for all commodities (PPI: All), which includes both intermediate and final goods and services, or PPI for final goods and services only (PPI: Final). For this problem, download the monthly U.S. CPI-U, PPI: All and PPI: Final from Jan. 2011 to Dec. 2020.

1. In one graph, plot the year-on-year inflation rates based on CPI-U, PPI: All, and PPI: Final from Jan. 2012 to Dec. 2020. (2 Points)

2. Which index – PPI: All or PPI: Final is more volatile? Which index tracks CPI better? (2 Points)