Discussion 1

1 Introduction

- Howard Hsu
- Sections:
  1. A1 Mon. 5-6 pm (SST 220A)
  2. A7 Thur. 6-7 pm (DBH 1200)
- Office Hour: Mon. 6-7 pm (SST 228)
- Economics Learning Center: Mon. 3-4 pm (SST 165)
- My Website: http://www.haochehsu.com (Handout can be found at the *Teaching* section)
  Alternative: The website can also be found at the first result if you Google my name.
- Email: haoche.hsu@uci.edu
- Course Web Page: https://eee.uci.edu/18f/62075
- Exam Dates:
  - Midterm: Fri. November 2nd (Class time)
  - Final: Fri. December 14th (1:30 –3:30 pm)

2 The 2018 Nobel price in Economics

- Paul Romer
- William Nordhaus

3 Math Review

To calculate the *percentage growth rate* of a given variable x:

$$\%\Delta x = \frac{x_f - x_i}{x_i} \times 100 = \frac{\Delta x}{x_i} \times 100 \tag{1}$$

where x_i is the **initial** value and x_f is the **final** value.

- Example (Inflation rate):

$$\%i = \frac{P_f - P_i}{P_i} \times 100 = \frac{\Delta P}{P_i} \times 100 \quad \text{or} \quad i = \frac{P_f - P_i}{P_i} = \frac{\Delta P}{P_i}$$

  where P_f and P_i are the price levels in the final and initial periods respectively[1].

- Example (Economic growth rate):

$$g_t = \frac{\text{GDP}_t - \text{GDP}_{t-1}}{\text{GDP}_{t-1}} \tag{2}$$

- Example (Demand elasticity from P_1 to P_2):

$$\eta = \frac{\%\Delta Q}{\%\Delta P} = \frac{\dfrac{Q_2 - Q_1}{Q_1}}{\dfrac{P_2 - P_1}{P_1}} \tag{3}$$

[1] If inflation rate < 0, then it is deflation.

4 Average Growth Rate and Approximation

Let g denotes the growth rate:

$$g = \frac{x_{t+1} - x_t}{x_t} \quad \text{or} \quad x_{t+1} = (1+g)x_t \tag{4}$$

Then the growth rates over multiple periods has the form

$$x_{t+n} = (1+g)^n \cdot x_t \tag{5}$$

and can be approximated with

$$g = \frac{\log(x_{t+n}) - \log(x_t)}{n} \tag{6}$$

• Growth rate computing rules.

5 Circular-flow Model, GDP and GNP

- GDP: Gross[2] Domestic Product (based on country, i.e. include residents and foreigners)
  1. Most widely used measure of aggregate economic activity.
  2. Measure **market value** of all **newly produced final goods and services** within the country in a given period of time.
  3. Y = C + I + G + (X-M)
     - Y = Output, Nominal GDP.
     - C = Consumption: durables, non-durables, services.
     - I = (Gross Private) Investment: Nonresidential fixed investment, residential fixed investment, inventories.
     - G = Government Purchases: Sum of federal, state, and local purchases of goods and services, and government investment. Government transfer payments not included.
     - X = Exports: deliveries of US goods and services to other countries.
     - M = Imports: deliveries of goods and services from other countries to the US. *Trade Balance = Exports - Imports*.
- GNP: Gross National Product (based on nationality include citizens that work abroad)
  1. National Income: broadest measure of the total income.
  2. GNP measures output produced by domestically owned factors, versus GDP which is output produced within a nation.
  3. Relationship:

$$\begin{aligned} &\text{GDP} + \underbrace{\text{Factor Income from abroad} - \text{Factor Income to abroad}}_{\text{Net Factor Income from Abroad (NFIA)}} \\ &= \text{GNP} \\ &\quad - \text{Depreciation}[3] \\ &= \text{Net National Product} \\ &\quad - \text{Statistical Discrepancy (adjust sampling bias, different log method)} \\ &= \text{National Income (e.g. labor, capital, rent,...)} \end{aligned}$$

     - Factor income from abroad: Income earned by residents from the rest of the world (ROW). e.g. wages, rent, interest, dividend, retained earnings.
     - Factor income to abroad: Income paid to non-residents for their labor rent in this country.

[2] Gross - depreciation (δ) = Net. e.g. GDP - δ = NDP.
Nominal $\xrightarrow[\text{adjusted by inflation}]{\text{divided by Index Number} \times 100}$ Real.

[3] Depreciation: The devaluation of fixed capital through wear and tear associated with its use in productive activities. (Wikipedia)

6 Index Number

The GDP calculation in the previous section is the Expenditures Approach. We will review the Price-Quantity Approach:

$$\text{GDP} = \sum_{i=1}^{n} P_i \cdot Q_i$$

$$\text{Nominal GDP} = \sum_{i=1}^{n} P_i^{\text{current year}} \cdot Q_i$$

$$\text{Real GDP} = \sum_{i=1}^{n} P_i^{\text{base year}} \cdot Q_i$$

Another alternative is the Value Added Approach: This method adds the value added of each good and service produced in the economy.

$$\text{Value added} = \text{Value of final good–Value of intermediate goods} \tag{7}$$

And the Income Approach: This method adds up the income paid to all the factors of production.

$$\text{GDP} = \text{wages} + \text{interest} + \text{rent} + \text{profit} \tag{8}$$

A price index is a weighted average of the prices of a set of the goods and services produced in the economy over a period of time. For example, the GDP deflator:

$$\text{GDP deflator} = \frac{\text{Nominal GDP}}{\text{Real GDP}} \times 100 \tag{9}$$

Unlike Consumer Price Index, GDP deflator doesn't measure with a fix "basket"of goods but all final goods or services that are produced in the country. We will now present the Consumer Price Index:

$$\text{CPI} = \frac{\text{Cost of a basket in given year}}{\text{Cost of basket in base year}} \times 100 \tag{10}$$

We can also use price indices to measure the inflation rate, which is the rate of change in the price level from one period of time to another.

7 Exercises

1. Which of the following is counted in GDP?
   (a) The value of goods and services produced in the underground economy (shadow economy).
   (b) The value of volunteer work as a Professor's research assistant.
   (c) The cost of a speedboat purchased at *boats.com* used by drug smugglers.
   (d) The value of leisure.
2. Consider the following information for a certain economy in 2018 (in billions of dollars):

   Self-employment Income = 700
   Personal Consumption = 9,300
   Gross private investment = 1,500
   Indirect business taxes = 650
   Government consumption and gross investment = 2,500
   Depreciation = 1,800
   Net exports = -500

   (a) \$12,800 (b) \$12,500 (c) \$11,400 (d) \$10,500

3. If the cost of a market basket is $170 in year 1 and $200 in year 2, the price index for year 1 using year 2 as the base is
   (a) 170 (b) 85 (c) 100 (d) 200
4. To examine how the production of goods has changed over time, it would be better to consider
   (a) Real GDP
   (b) Nominal GDP
   (c) GDP deflator
   (d) GDP at current prices
5. If a used-car dealer purchases a used car for $4,000, restores it, and resells it for $4,800, the dealer contributes
   (a) Value added equal to $4,800, but nothing is added to GDP
   (b) Value added equal to $4,800, but only $800 is added to GDP
   (c) Value added equal to $800, and consequently $800 is added to GDP
   (d) Nothing to production because only existing goods are involved
6. True or False: Investment spending is spending on productive physical capital. According to the national accounts system, the construction of a new house would be included as a part of investment spending.
7. The difference in the definition between Real and Nominal GDP is
   (a) that Real GDP is measured by excluding some of the sectors.
   (b) that Real GDP is always smaller than Nominal GDP.
   (c) that they are calculated using different price levels.
   (d) Answers (a), (b), and (c) are all True
   (e) Answers (a), (b) and (c) are all False
8. If prices are rising *on average*, then which of the following is true?
   (a) real GDP will always be equal to nominal GDP
   (b) real GDP will be greater than nominal GDP in the years after the base year
   (c) real GDP will be greater than nominal GDP in the years before the base year
   (d) real GDP will be less than nominal GDP in the years before the base year
9. Consumption spending usually makes up approximately what portion of GDP?
   (a) 25% (b) 30% (c) 50% (d) 90%
10. Derive the relationship between *saving-investment* (S-I) and *net exports* (NX).
11. Which of the following would not be included in the expenditure category called investment expenditures?
   (a) Consumers' spending on new houses at Woodbridge.
   (b) Purchase of a copy machine by the Economics Department office.
   (c) A purchase of shares of *Apple Inc.* stock.
   (d) The cars held in inventory on a local Audi dealer's lot.

8 Appendix

Here we will show the following:

$$\log(1+x) \approx x \tag{11}$$

where x is small. To approach this problem we need to utilize Taylor expansion.

8.1 Taylor Expansion

The expansion of function $f(x)$ at point a has the form

$$f(x) = f(a) + \frac{1}{1!}f'(a)\cdot(x-a)^1 + \frac{1}{2!}f''(a)\cdot(x-a)^2 + \cdots + \textit{Remainder term} \tag{12}$$

Let $f(x) = \log(1+x)$ and expand at point 0[4] (let $a = 0$):

$$\begin{aligned}
\log(1+x) &= \log(1+0) + \frac{1}{1+0}\cdot(x-0)^1 + \frac{1}{2!}\cdot(-1)(1+0)^{-2}\cdot(x-0)^2 + \cdots \\
&= \underbrace{\log(1)}_{=0} + x - \frac{x^2}{2} + \frac{x^3}{3} - \frac{x^4}{4} + \cdots \\
&= x \underbrace{- \frac{x^2}{2} + \frac{x^3}{3} - \frac{x^4}{4} + \cdots}_{\text{very small when } x \text{ is small}} \\
&\Longrightarrow \log(1+x) \approx x
\end{aligned}$$

[4] When the expansion occurs at point 0, this is called the Maclaurin Series.