1 Gross Domestic Product(GDP)

1.1 Definition

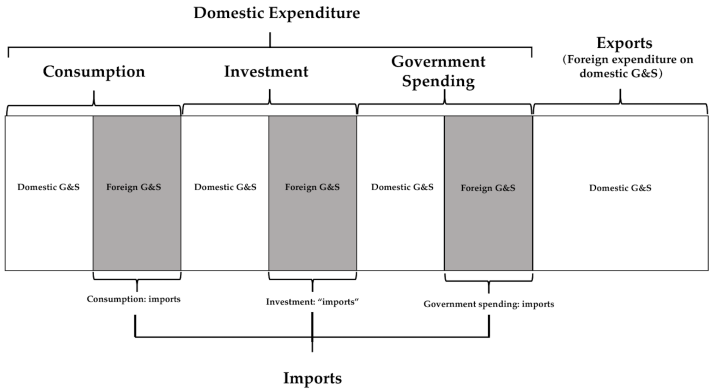
GDP measures the **market value** of **final goods and services** produced **within a country over a given time period**, typically a year. Examples that are not counted in GDP:

- The value of do-it-yourself work
- The value of leisure
- Intermediate goods

1.2 GDP from expenditure side

Because all the final goods and services in an economy are purchased by consumers, and because for the economy as a whole, income must equal expenditure, GDP can be calculated as the sum of total expenditure in the economy.

- Closed economy: $\mathrm{Y} = \mathrm{C} + \mathrm{I} + \mathrm{G}$
- Open economy: $\mathrm{Y} = \mathrm{C} + \mathrm{I} + \mathrm{G} + \mathrm{NX}$



$$\begin{aligned}\text{GDP} = &(\text{Consumption} - \text{Consumption: imports})\\ &+ (\text{Investment} - \text{Investment: imports})\\ &+ (\text{Government spending} - \text{Government spending: imports})\\ &+ \text{exports}\\ \text{GDP} = &\ C + I + G + \text{exports} - \text{imports} = C + I + G + NX\end{aligned}$$

1.3 Nominal GDP & Real GDP

Nominal GDP is measured using the prices of the year in which the output was produced. Real GDP is measured as if prices had remained at the level of some given year called the base year.

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

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

2 Data Manipulation

2.1 FRED Data

- https://fred.stlouisfed.org/
- Provide aggregate time series data across countries
- Could be imported directly in Stata: import fred **Series ID**, clear

2.2 Detrend Data

Let Y_t be a variable of interest: $Y_t = \alpha + \beta t + \epsilon_t$, we can estimate α and β from linear regression. Trend is $\hat{Y}_t = \hat{\alpha} + \hat{\beta} t$, cyclical component is: $Y_t - \hat{Y}_t$. Steps for data manipulation:

- Set time variable t: use tsset in stata or generate a sequence of number($t = 1, 2, 3, 4, ...$)
- Regress Y_t on time variable and get the estimated coefficient $\hat{\alpha}$, $\hat{\beta}$
- Calculate trend $\hat{Y}_t$: $\hat{Y}_t = \hat{\alpha} + \hat{\beta} t$
- Calculate cyclical component(deviation from trend): $Y_t - \hat{Y}_t$

2.3 Useful Functions in Excel

- Natural logarithm: *=LN(number)*
- Mean: *=AVERAGE(range)*
- Correlation: *=CORREL(array1, array2)*
- Linear regression:
  - Return slope: *=LINEST(y_range, x_range, TRUE, FALSE)*
  - Return intercept: *=INDEX(LINEST(y_range, x_range, TRUE, FALSE), 2)*

2.4 Sample Code in Stata

See the next page.