Muhammad Rahman
Indiana University
Bloomington

CHAPTER -2

A. Objective of the chapter

Gross Domestic product (GDP) is the dollar value of final output produced during a given period of time within the borders of USA. We will learn five things in this chapter:

1. We will learn three approaches to calculate Gross Domestic product (GDP), look at their relative merits and analyze their limitations.
2. We will formally look at GDP and its various components by using Expenditure approach.
3. We will various measurement issues related with calculating Real and Nominal GDP and Price indices.
4. We will formally look at savings wealth and income calculations.
5. We will look at some labor market measurement issues and analyze their significance and usages.

B. Various Approaches to calculating GDP

1. The experiment

We will setup an experimental economy to analyze the various ways of calculating GDP. The experimental economy is an island where we have four agents, a coconut producer, a restaurant owner, a government and finally, a consumer:

a. **Coconut Producer:** He is both an intermediate good (Coconut for restaurant) and final good producer (raw coconut) who does the following economic activities:
   i) Collects coconut.
   ii) Takes loans from the consumer and pays interest on these loans
   iii) Employees to his coconut collecting operation and pays wages
   iv) Pays tax to the government.

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Indiana University
Bloomington

b. **A Restaurant Owner**: He is a final goods producer(Finished coconut based meal) who does the following economic activities:
   i) Produces final goods.
   ii) Hires workers and pays them wage.
   iii) Buy coconut as input for his restaurant from the coconut producer.
   iv) Pays taxes to the government.

c. **The Consumer**: He does the following economic activities:
   i) Consumes final goods (restaurant meals).
   ii) Consume some intermediate goods as final goods (raw coconut).
   iii) Works for the coconut producer and the restaurant owner and receives wages.
   iv) Receives interest payment from the coconut producer.
   v) Some of them own the restaurant and some them owns the coconut collecting industry.

d. **The Government**: the government does the following:
   i) Collect tax.
   ii) Hire some workers and pay wages.
   iii) Provide defense services to the island.

Critical Thinking: you can think the consumer as the producer and the consumer and even as the government. This then becomes a "Robinson Cruiso" Economy.

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Indiana University
Bloomington

2. The Economic Activity

The economic activities are summarized as follows:

Table 2.1 Coconut Producer:

Collects 10 million coconuts and sells 6 million units to the restaurant owner and 4 million units to the consumer at $2.00 per unit.

Total Revenue	$20 million
Wages	$5 million
Interest on Loan	$0.5 million
Taxes	$1.5 million

Table 2.2 Restaurant Owner

Total Revenue	$30 million
Cost of Coconuts	$12 million
Wages	$4 million
Taxes	$3 million

Table 2.4 Government

Tax Revenue	$5.5 million
Wages	$5.5 million

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Indiana University
Bloomington

Table 2.3 After-Tax Profits

After tax profits = Total revenue – wage - Interest payments - cost of intermediate inputs-tax
So,
After tax profits for Coconut producer = 20.00 – 5.00 – 0.5 – 1.5 = 13.00
After tax profits for restaurant owner = 30.00 - 4.00 – 12 – 3 = 11

Coconut Producer	$13 million
Restaurant	$11 million

a. **Product approach to GDP**

- Also known as the "Value added Approach".
- This approach used to be used by the National Income and Product Accounts (NIPA), which is part of the Ministry of Commerce".
- In this approach, GDP is calculated by adding up the value of all final goods and services in the economy minus the value of the intermediate goods. This is done to prevent "double counting".
- Value added for the Coconut Producer = TR – 0 = 20.00 – 0 = 20.00
- Value added for the Restaurant owner = 30.00 – 12.00 = 18.00
- When we calculate the value added for the government, we only consider the wages paid by the government. This is because there is no market price for the "defense services" provided by the government and thus it is not possible to calculate the value of the service. Therefore
  The valued added for the government = wages = 5.5
- **Consumers do not add any value to the economy. They just transfer value from one side of the market (producer) to the other side (government) and vice versa.**

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Indiana University
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Critical Thinking: Why are the wages paid by the producers not included as the value added?
Answer: They are thought as intermediate goods or inputs.

Table 2.6 GDP Using the Product Approach

Value added—coconuts	$20 million
Value added—restaurant food	$18 million
Value added—government	$5.5 million
GDP	$43.5 million

b. Expenditure Approach to GDP

- This is the approach currently used by NIPA to calculate GDP
- GDP is calculated as the sum of total spending on all final goods and services produced in the economy.
- GDP = Total Expenditure = C + I + G + NX
  Where,
- C = Consumption expenditure = Consumption spending.
- I = Investment Expenditure = Business Spending
- G = Government Spending
  NX = Net export = Export –Import

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Indiana University
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Critical Thinking: Why do we subtract Import from GDP?
Answer: There are two reasons. First, Spending on Imported goods by consumer and the producer has already been included in C and I. We subtract Import to have a precise measure of the economic activity within the borders of USA. Second, Imported goods are final goods that were produced abroad. So, they should not be included in the GDP

- In our experimental economy, I=0, NX=0(Island economy).
- C = Expenditure on restaurant food + expenditure on raw coconut = 30 + 8 =38 million
- Government spending should include both defense and non-defense expenditure. In this experimental economy, there is no measurement for the defense services. Hence we take only the wages paid by the government to his army and also to his employees, assuming like government is purchasing the defense service by spending the wages. So, the expenditure by the government = 5.5 million

Table 2.7 GDP Using the Expenditure Approach

Consumption	$38 million
Investment	0
Government Expenditures	$5.5 million
Net Exports	0
GDP	$43.5 million

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Indiana University
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c. Income approach to GDP

- GDP is calculated by adding up all the incomes received by economic agents contributing to production.
- Income in this definition includes:

i) Compensation of employees (wages, salaries, benefits).
ii) Proprietor's income (self-employed firm owners.
iii) Rental income.
iv) Corporate profits.
v) Net interest (interest income).
vi) Indirect tax (sales tax).
vii) Depreciation = portion of the productive capital that wears out.

- Consumers income = wages received + interest income from loans = 14.5 + 0.5=15.0
- Producers' income = after tax profit = 13 + 11 = 24
- Government's income = tax from producers = 1.5 + 3 = 4.5

Critical Thinking: Why is tax paid by the consumer not included in the government's income?
Answer: The answer is not clear. One explanation might be that the consumers do not contribute to the production. Hence the tax they pay should not be included in the GDP calculation. This argument is not that strong.

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Indiana University
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Table 2.8 GDP Using the Income Approach

Wage income	$14.5 million
After-tax profits	$24 million
Interest income	$0.5 million
Taxes	$4.5 million
GDP	$43.5 million

INCOME EXPENDITURE IDENTITY

Since GDP calculation is same in income and expenditure approach, we can write**:**

AGGREGATE INCOME = Y = GDP = AGGREGATE EXPENDITURE = C + I + G + NX

3. Extension to include inventory investment

Inventory investment is part of investment which are goods produced in current period but not consumed. They include:

i) Inventory to finished goods.
ii) Goods in process.
iii) Raw materials.

Suppose the coconut producer produces 13.0 million units, 3.0 millions are not consumed but stored. We see:

- In value added approach:
  Value added to the coconut producer = 13*2 = 26.00
  Value added to restaurant owner = no change = 18.0
  Value added to the government = no change = 5.5
  So, **GDP in Value added approach = 49.5**

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Indiana University
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- In the Expenditure approach:
  C = no change = 38.00, I=6.00, NX=0, G =5.5
  So, **GDP in expenditure approach = 49.5**
- In the income approach:
  Inventory is added as part of the profit to the coconut producer for which no additional tax is charged. Hence After tax profit for the coconut producer = 13.00 + 6.00 = 19.00
  After tax profit for the Restaurant owner = no change = 11.00
  Government's income = no change = 4.5
  Consumer's income = no change = 15.00
  So, **GDP in income approach = 49.5**

4. GDP Vs GNP

GNP = GDP + NFP

Where, NFP = Net factor payment from abroad

In, 2002, GDP = $10,446.2 billion

GNP = $10,436.7 billion

Hence analysis based on GDP is very similar to analysis based on GNP

5. What Does GDP Calculation leave out?

a) GDP calculation does not reflect how income is distributed.
b) It leaves out non-market activity (eating at home?).
c) Does not take into consideration of underground economy, which is unreported economic activity (illegal drugs, baby sitting).
d) Leaves out major portion of government activity (defense) most of the times.

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Indiana University
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C. Formal look at the GDP: Expenditure approach

1. Objective

We only want to look at the expenditure side of the economy. So, GDP would be calculated as,
GDP = C + I + G + NX

2. Components of aggregate expenditure

- **Consumption**: it is the expenditure on goods and services during a current period.
  It includes**:**
  i) **Durables**: these are the expenditures on goods such as automobiles, appliances, furniture.
  ii) **Non-Durables**: These are expenditures on perishables like food and also clothing.
  iii) **Services**: These are expenditures on non-tangible goods such as haircuts and hotel services.

  It does not include:
  i) Purchase of used durables such as used car.
  ii) " " non-durables such as used clothing

  But, it does include:
  i) Services provided by selling used durables, such as services by a used car dealer.
  ii) Services provided by selling used non-durables, such as services by goodwill.
- **Investment**: it is the expenditure on goods that are produced but not consumed during the current period.
  It includes**:**
  i) **Fixed investment**: these are the expenditures on production of capital such as plant or house. This include:
    - Residential: Production of houses.
    - Non- residential: production of plant.

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Indiana University
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ii) **Inventory investment**: these are the expenditures on goods that are put in storage

Critical Thinking: Confusion between Consumption and Investment

1) If you buy an automobile in current period and it provides services for 10 years, then purchase of the car fall into durables during the current year and falls into services this year and next 10 years.
2) If you buy an automobile for your company, that might be treated as fixed investment.

- **Net Export**: This is the difference between export and import where,
  i) **Export:** Goods and services produced at home and sold abroad**.**
  ii) **Import:** Goods and services produced abroad but sold at home
- **Government expenditure:** This is the total government expenditure on final goods and services.

  It includes:

  i) **Federal Expenditure**: this is central government's expenditure.

  This includes:

  - Federal defense: largest government expenditure.
  - Federal non-defense: salary of workers. Building roads. Public schools.

  iii) **State:** Mainly state level non-defense expenditures. Examples are public schools.

  iv) **Local:** similar local level non-defense expenditures such as public schools, police services.

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Indiana University
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Critical Thinking: Which ones are the largest component of federal expenditure, state and local expenditures?
Answer: for federal level it is the defense. For state level, it is education. For local level, it is either police or education.

Critical Thinking

Q: what is not included in government expenditure in the expenditure approach?
Answer: transfers such as social security payments, unemployment benefits are not included in G. These are transfers of purchasing power from one group (tax payer) to another group (recipient)
Q: Which approach includes transfers?
Answer: Income approach as compensation to workers

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Indiana University
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Table 2.9 Gross Domestic Product for 2002

Component of GDP	*$ Billions*	*% of* GDP
GDP	10,446.2	100
Consumption	7,307.7	70.0
Durables	871.9	8.3
Nondurables	2,115.0	20.2
Services	4,316.8	41.3
Investment	1,593.2	15.3
Fixed investment	1,589.3	15.2
Nonresidential	1,117.4	10.7
Residential	471.9	4.5
Inventory investment	3.9	0.0
Net exports	−423.6	−4.1
Exports	1,014.9	9.7
Imports	−1,438.5	−13.8
Government expenditures	1,972.9	18.9
Federal defense	447.4	4.3
Federal nondefense	246.3	2.4
State and local	1,279.2	12.2

Muhammad Rahman
Indiana University
Bloomington

D. NOMINAL AND REAL GDP AND PRICE INDEX

1. Objective

We want to compare GDP over time. So we need an absolute measure of GDP that adjusts for relevant changes in other variables such as price. Comparing nominal GDP between two years when price varies tells us nothing.

2. Nominal GDP

It is the total value of goods and services produced within a given year. In general terms,
$NGDP_t = P^1_t * Q^1_{t+} P^2_t * Q^2_{t+}$ ------

3. Real GDP

Real GDP is calculated by assuming a base year and calculated GDP using the base year.

Table 2.10 Data for Real GDP Example

	Apples	*Oranges*
Quantity in year 1	$Q^a_1 = 50$	$Q^o_1 = 100$
Price in year 1	$P^a_1 = \$1.00$	$P^o_1 = \$0.80$
Quantity in year 2	$Q^a_2 = 80$	$Q^o_2 = 120$
Price in year 2	$P^a_2 = \$1.25$	$P^o_2 = \$1.60$

In the example, Nominal GDP in year 1 = $NGDP_1 = P_1^a * Q_1^a + P_1^o * Q_1^o = (1.00*5.00) + (0.80*100)$

Similarly, $NGDP_{2} = (1.25*80) + (1.60*120) = 292.00$.

Now, if we use year 1 as the base year, then,

$RGDP^1_1 = NGDP_1 = 130.00$

$RGDP^1_2 = (1.00*80) + (0.80*120) = 176.00$

If we use year 2 as the base year, then,

$RGDP^2_1 = (1.25*50) + (1.60*100) = 6.25 + 160 = 222.50$

$RGDP^2_2 = NGDP_2 = 292.00$

Muhammad Rahman
Indiana University
Bloomington

4. Why is the difference between NGDP and RGDP important?

Percentage change in NGDP = ((292-130)/130)*100 = 124.62%
Percentage change in RGDP1= ((176-130)/130)*100 = 35.38%
Percentage change in RGDP2 = ((290-222.50)/222.50)*100 = 31.24%
We see the following:

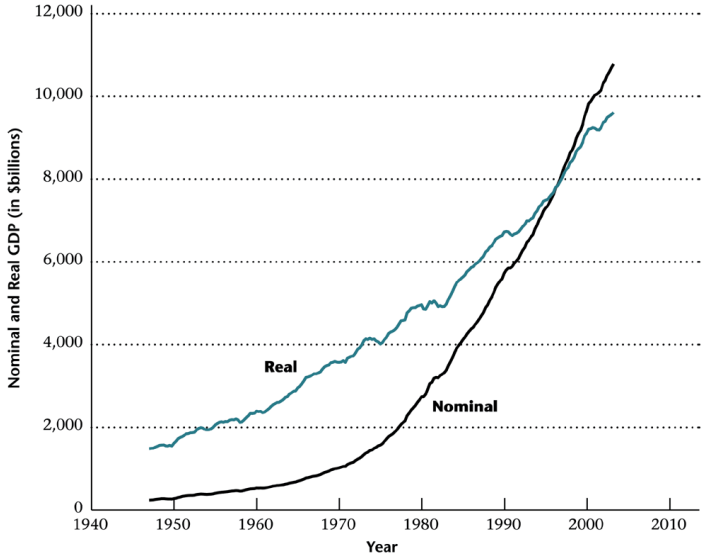
i) Calculating the change in GDP by using NGDP is upward biased because of inflation.
ii) Calculating change in GDP by using RGDP is more accurate because price is constant.
iii) Calculating the change in GDP using RGDP depends on which year is used as the base year.

5. Use of chain weighted index to calculate RGDP

- This is also known as the "Fisher Index".
- This index derives a more accurate measurement of GDP which is used by NIPA
- The fisher index is defined as, $g_c=\sqrt{g_1 * g_2}$
- Where, g_1= ratio of RDP with year 1 as base year = RGDP1/ RGDP12= 176/130 = 1.354
- And, g_2 = ratio of RGDP with year 2 as the base year = RGDP21/ RGDP22 = 292.0/222.50 = 1.312
- Therefore, $g_c=1.354*1.312=1.333$
- Finally, percentage change in GDP using chain index = (1.333-1)*100 = 33.3%

Muhammad Rahman
Indiana University
Bloomington

Figure 2.1 Nominal GDP (black line) and Chain-Weighted Real GDP (colored line) for the Period 1947–2003



6. Measurements of the Price level

- There are two popular meadsure of price level:
  - i) **Implicit GDP deflator:** It is defined as, GDP deflator = (Nominal GDP/Re
    This is also known as the "Passche Price index"
  - ii) **Consumer Price Index (CPI)**: This is the most popular measure of price. It is defined as,

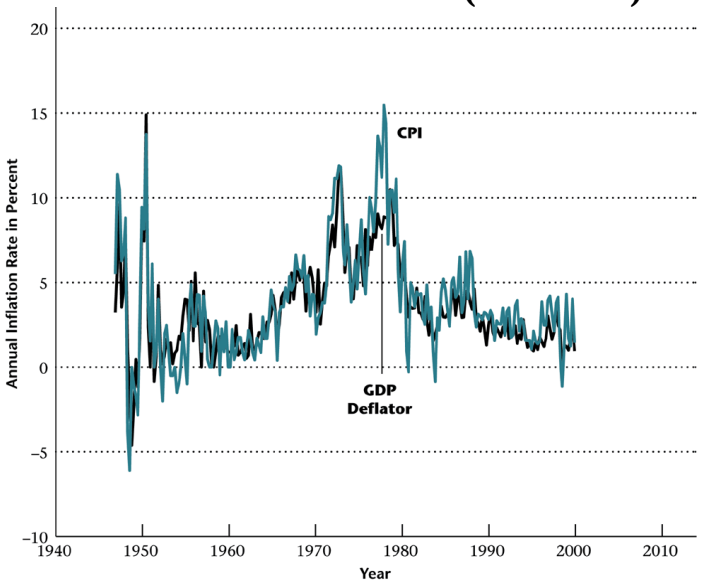
CPI = (Cost of the base year quantity basket at current price/Cost of the base year quantity basket at base year price)*100

This is also known as "Laspayeres Price index"

- In data CPI is more volatile than GDP deflator

Muhammad Rahman
Indiana University
Bloomington

Figure 2.2 Inflation Rate Calculated from the CPI (blue line), and Calculated from the Implicit GDP Price Deflator (black line).



7. Measurement Problems:

- **Laspayeres Index:** Fixed basket of goods, overstate price increase because ignores substitution.
- **Paasche Index:** By changing basket of goods, it understates price increase because it ignores reduction in welfare.
- **Other Measurement issues:**
  - i) Relative price change
  - ii) Change in quality of goods.
  - iii) How to take account of new goods (like computer).

Muhammad Rahman
Indiana University
Bloomington

E. MEASURMENT WITH SAVINGS, WEALTH AND CAPITAL

1. Objective

Savings is an important variable to the consumer. Savings creates a bridge between Investment and Consumption. Hence we will look at how savings is related to our GDP calculation.

2. Difference between Stock and Flow variables

- **Stock:** existence of some variable at some point of time. Example: number of houses in USA.
- **Flow:** This is the rate of a variable per unit of time. Example: GDP, consumption.

Critical Thinking

In NIPA calculation, we measure the flow variables. Thus National savings is a flow variable and national wealth is stock variable

3. Personal Disposable Income(Y^d)

$$Y^d = Y + NFP + TR + INT - T$$

where,

Y = total gross income.

NFP = net factor payments.

TR = transfers from government.

INT = interest on government debt.

T = tax

4. Savings of the Economy:

There are different kinds of savings in the economy:

- **Private Savings:** $S^P = Y^d - C = Y + NFP + TR + INT - T - C$
- **Government savings:** $S^g = T - TR - INT - G$

  When $S^g < 0$, we have deficit

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Indiana University
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- **National Savings: $S = S^P + S^g = Y - NFP - C - G$**
  Now $Y = C + I + G + NX$
  So, $S = I + NX + NFP$

5. **Current Account: CA = NFP + NX**

SAVINGS-INVESTMENT IDENTITY
$S = I + CA$

Critical Thinking

- National wealth and therefore savings is calculated by using Income approach. This approach is very important for our Macro Model Building.
- If CA =0, then we have the more familiar Savings –Investment Identity of
  S = I

F. LABOUR MARKET MEASURMENT

1. Objective

Unemployment is a major macroeconomic issue. In order to understand and calculate unemployment we need to be familiar with labor market measurement

2. Labor Force:

- Defined as : **LF = Employed + Unemployed**
  Where, Employed = people who had a full or part time job during the survey.
  Unemployed = People who did not have a job and is actively searching for jobs
- **Does not include**
  i) People who are institutionalized (mental hospital, jail).
  ii) People who are in the army.

Muhammad Rahman
Indiana University
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Critical Thinking

- Why are institutionalized people not included in labor force?
- Why are people who are in the army not included in labor force?
- Are foreign citizens such as legal (and also illegal) Mexican workers, international graduate students, post doctoral fellows) included in the labor force?

3. Unemployment rate:

UR = Number of people unemployed/labor force

4. Labor force participation rate:

PR = Labor Force/Total working age population

Critical Thinking

UR measures labor market tightness

5. Labor market measurement problems:

- Discouraged workers are misrepresented.
- UR does not adjust for search intensity