

# ECON3123

## Macroeconomic Theory I

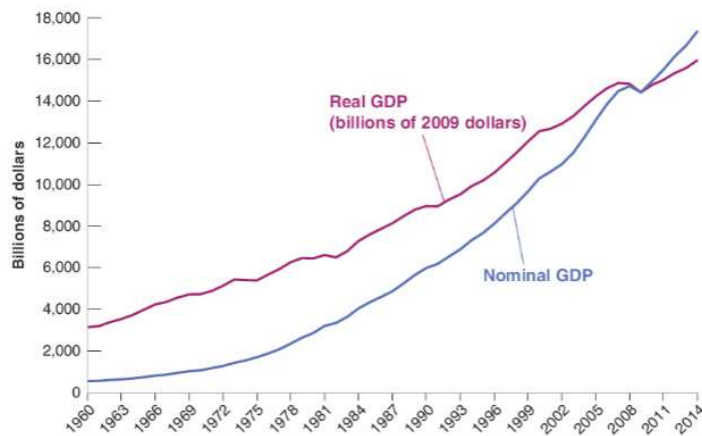
Tutorial #2: More on GDP; Unemployment and Inflation

## Today's tutorial

- Real and Nominal GDP
- Unemployment
- Inflation

## Real and Nominal GDP

- Nominal GDP:
  - the quantities of final goods  $\times$  **current prices**
- Real GDP:
  - the quantities of final goods  $\times$  **constant prices**



- We want a measure of the size of an economy that does not depend on how prices have changed

- From 1960 and 2014, nominal GDP increased by a factor of 32.  
Real GDP increased by a factor of about 5.

## Calculating nominal and real GDP: Basic approach

Nominal GDP in Year 0 and in Year 1.

	Year 0		
	Quantity	\$ Price	\$ Value
Potatoes (pounds)	10	1	10
Wine (bottles),	5	2	10
Nominal GDP			
	Year 1		
	Quantity	\$ Price	\$ Value
Potatoes (pounds)	15	1	15
Wine (bottles),	5	3	15
Nominal GDP			

- Nominal GDP

- Year 0 =

- Year 1 =

⇒ Nominal GDP growth =

## Calculating nominal and real GDP: Basic approach

### Nominal GDP in Year 0 and in Year 1.

		Year 0	
	Quantity	\$ Price	\$ Value
Potatoes (pounds)	10	1	10
Wine (bottles), Nominal GDP	5	2	10
		Year 1	
	Quantity	\$ Price	\$ Value
Potatoes (pounds)	15	1	15
Wine (bottles), Nominal GDP	5	3	15

- Real GDP using Year 0 prices
  - Year 0 =
  - Year 1 =
  - => Real GDP growth (using Year 0 prices) =
- Real GDP using Year 1 prices
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  - => Real GDP growth (using Year 1 prices) =

## Calculating nominal and real GDP: Basic approach

### Nominal GDP in Year 0 and in Year 1.

		Year 0	
	Quantity	\$ Price	\$ Value
Potatoes (pounds)	10	1	10
Wine (bottles),	5	2	10
Nominal GDP			
		Year 1	
	Quantity	\$ Price	\$ Value
Potatoes (pounds)	15	1	15
Wine (bottles),	5	3	15
Nominal GDP			

- Real GDP using Year 0 prices = 25%
- Real GDP using Year 1 prices = 20%
- Average Real GDP growth =
- Real GDP growth in Year 1 with base year Year 0 =

## Calculating real GDP: Chained Index approach

- Limitations of the basic approach to calculating real GDP:

### Nominal GDP in Year 0 and in Year 1.

	Quantity	Year 0	
		\$ Price	\$ Value
Potatoes (pounds)	10	1	10
Wine (bottles), Nominal GDP	5	2	10

	Quantity	Year 1	
		\$ Price	\$ Value
Potatoes (pounds)	15	1	15
Wine (bottles), Nominal GDP	5	3	15

- Real GDP using Year 0 prices
  - Year 0 = 20
  - Year 1 =  $15 \times 1 + 5 \times 2 = 25$
$$\Rightarrow \text{Real GDP growth (using Year 0 prices)} = \frac{(25-20)}{20} = 25\%$$
- Notice that this figure relies on the relative prices of Potatoes and Wine in the base year
  - It is the relative prices that determine the weights of the goods in the real GDP measure

## Calculating real GDP: Chained Index approach

- Real GDP using Year 0 prices
  - Year 0 = 20
  - Year 1 =  $15 \times 1 + 5 \times 2 = 25$
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- Notice that this figure relies on the relative prices of Potatoes and Wine in the base year
  - It is the relative prices that determine the weights of the goods in the real GDP measure

- This causes problems:
  - Old relative prices may not reflect the true current values of different goods
  - Some goods may not even exist in the base year
- Therefore, the base year should be updated
- Then, everything should be re-calculated
- The growth rate of real GDP will change, and so on



## Calculating real GDP: Chained Index approach

- Chain-Weighting: a way to address these problems
- The approach:
  1. Calculate real GDP for year 0 and year 1 using year 0 prices, and then their ratio
    - $\text{Real GDP}(0,0) =$
    - $\text{Real GDP}(1,0) =$
    - $\text{Ratio}(1,0,0) =$

Nominal GDP in Year 0 and in Year 1.

	Quantity	Year 0	
		\$ Price	\$ Value
Potatoes (pounds)	10	1	10
Wine (bottles), Nominal GDP	5	2	10

	Quantity	Year 1	
		\$ Price	\$ Value
Potatoes (pounds)	15	1	15
Wine (bottles), Nominal GDP	5	3	15

## Calculating real GDP: Chained Index approach

2. Calculate real GDP for year 0 and year 1 using year 1 prices, and then its rate of change (ie real GDP growth)

- $\text{Real GDP}(0,1) =$

- $\text{Real GDP}(1,1) =$

- $\text{Ratio}(1,0,1) =$

Nominal GDP in Year 0 and in Year 1.

	Quantity	Year 0	
		\$ Price	\$ Value
Potatoes (pounds)	10	1	10
Wine (bottles), Nominal GDP	5	2	10

	Quantity	Year 1	
		\$ Price	\$ Value
Potatoes (pounds)	15	1	15
Wine (bottles), Nominal GDP	5	3	15

## Calculating real GDP: Chained Index approach

3. Take a geometric average of the ratios, and subtract 1 to obtain the Chain-Weighted growth rate

$$\begin{aligned} & \bullet \sqrt{\text{Ratio}(1,0,0) \times \text{Ratio}(1,0,1)} - 1 = \\ & = \\ & = \end{aligned}$$

Nominal GDP in Year 0 and in Year 1.

	Quantity	Year 0	
		\$ Price	\$ Value
Potatoes (pounds)	10	1	10
Wine (bottles), Nominal GDP	5	2	10

	Quantity	Year 1	
		\$ Price	\$ Value
Potatoes (pounds)	15	1	15
Wine (bottles), Nominal GDP	5	3	15

- Repeat for each year to give a time series of chain-weighted growth rates

## Calculating nominal and real GDP: Basic approach

### Nominal GDP in Year 0 and in Year 1.

		Year 0	
	Quantity	\$ Price	\$ Value
Potatoes (pounds)	10	1	10
Wine (bottles), Nominal GDP	5	2	10
		Year 1	
	Quantity	\$ Price	\$ Value
Potatoes (pounds)	15	1	15
Wine (bottles), Nominal GDP	5	3	15

- Nominal GDP
  - Year 0 =  $10 \times 1 + 5 \times 2 = 20$
  - Year 1 =  $15 \times 1 + 5 \times 3 = 30$
  - ⇒ Nominal GDP growth =  $(30-20)/20 = 50\%$
- Real GDP using Year 0 prices
  - Year 0 = 20
  - Year 1 =  $15 \times 1 + 5 \times 2 = 25$
  - ⇒ Real GDP growth (using Year 0 prices) =  $(25-20)/20 = 25\%$
- Real GDP using Year 1 prices
  - Year 0 =  $10 \times 1 + 5 \times 3 = 25$
  - Year 1 = 30
  - ⇒ Real GDP growth (using Year 1 prices) =  $(30-25)/25 = 20\%$
- Average Real GDP growth =  $\frac{1}{2} \times (25 + 20) = 22.5\%$
- Real GDP growth in Year 1 with base year Year 0 =  $20 \times (1 + 0.225) = 24.5\%$

## Calculating real GDP: Chained Index approach

- Chain-Weighting: a way to address these problems
- The approach:
  - Calculate real GDP for year 0 and year 1 using year 0 prices, and then their ratio
    - Real GDP(0,0) = 20; Real GDP(1,0) = 25
    - Ratio(1,0,0) =  $25/20 = 1.25$
  - Calculate real GDP for year 0 and year 1 using year 1 prices, and then its rate of change (ie real GDP growth)
    - Real GDP(0,1) = 25; Real GDP(1,1) = 30
    - Ratio(1,0,1) =  $30/25 = 1.20$
  - Take a geometric average of the ratios, and subtract 1 to obtain the Chain-Weighted growth rate
    - $\sqrt{\text{Ratio}(1,0,0) \times \text{Ratio}(1,0,1)} - 1 = \sqrt{1.25 \times 1.20} - 1 \approx 22.5\%$

Nominal GDP in Year 0 and in Year 1.

	Quantity	Year 0	
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Wine (bottles), Nominal GDP	5	2	10

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		\$ Price	\$ Value
Potatoes (pounds)	15	1	15
Wine (bottles), Nominal GDP	5	3	15

## Employment and Unemployment

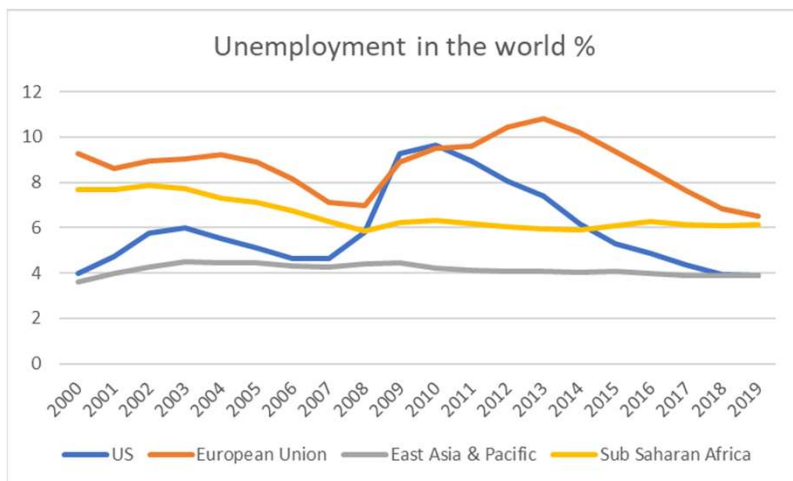
- Definitions: Total Labour Force, Employed and Unemployed

$$\begin{array}{ccccc} \begin{array}{|c|} \hline \text{Total} \\ \text{Labour} \\ \text{Force} \\ \hline \end{array} & = & \begin{array}{|c|} \hline \text{Number of} \\ \text{Employed} \\ \hline \end{array} & + & \begin{array}{|c|} \hline \text{Number of} \\ \text{Unemployed} \\ \hline \end{array} \end{array}$$

$$L = N + U$$

- N = Number of people employed
- U = Number of people without a job who are looking for one
- Distinguish Labor Force from **Discouraged Workers**:
  - Those who don't have a job and are not looking for one are counted as not in the labor force. These people are known as discouraged workers.*

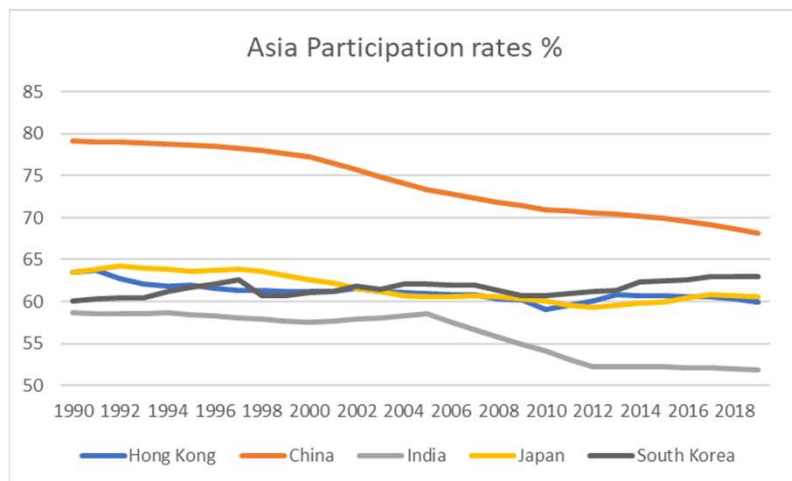
## Unemployment in context



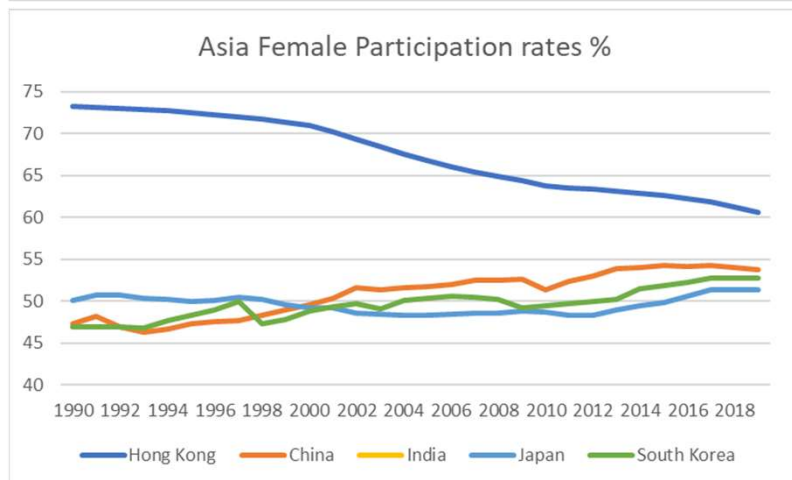
- Unemployment typically lower in the US and Asia than in the European Union
- But: unemployment falling in recent years since the financial crisis
  - Impact of macro and micro economic policies
- Notice how unemployment increased in the US and EU after the financial crisis
- Role of 'underemployment' in sub-Saharan Africa
- Unemployment typically low in Asia
- Measured unemployment is low in China and India
  - Role of 'under-employment'?
- Cultural factors behind unemployment



## Key idea: the Participation rate



- Participation rate = 
$$\frac{\text{Labor force}}{\text{Total population of working age}}$$
- Reflects:
  - Long term unemployment and discouraged workers
  - Important social phenomenon eg role of women in the workforce and how it is changing

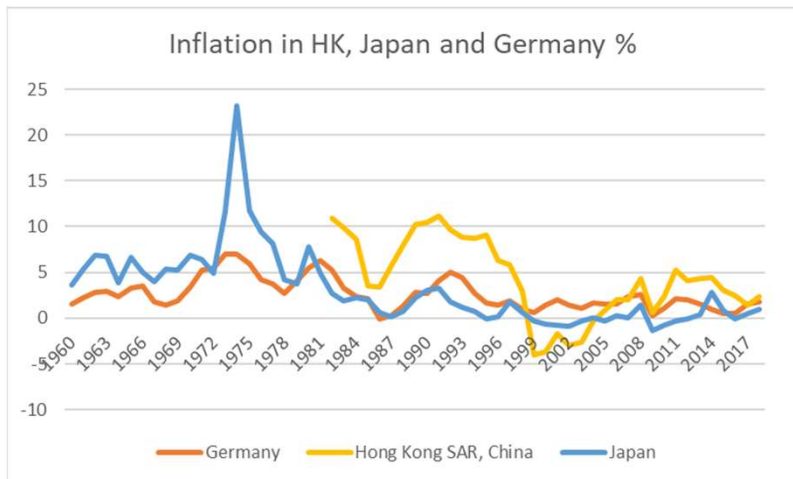
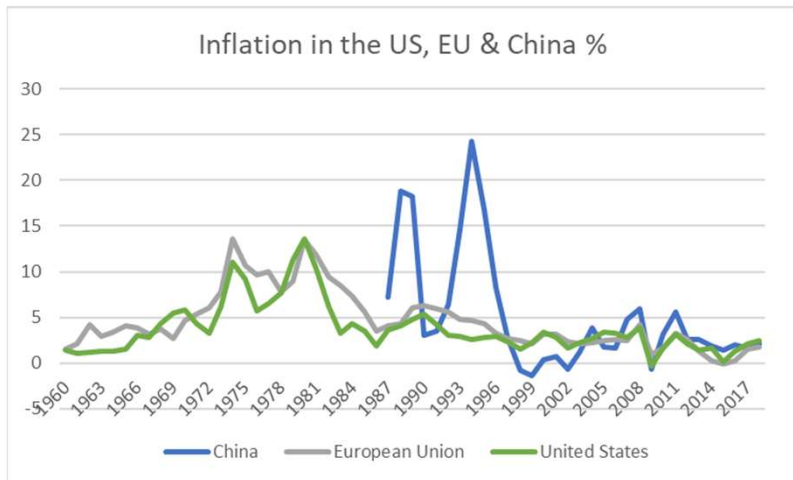




## Inflation

- Inflation is defined as a persistent change in the general price level
  - Inflation: Prices generally rising
  - Deflation: Prices generally falling
- We need a measure of prices in an economy: we use price indices
- There are many price indices that we could use; we choose two of them:
  - GDP deflator
  - Consumer Price Index (CPI)

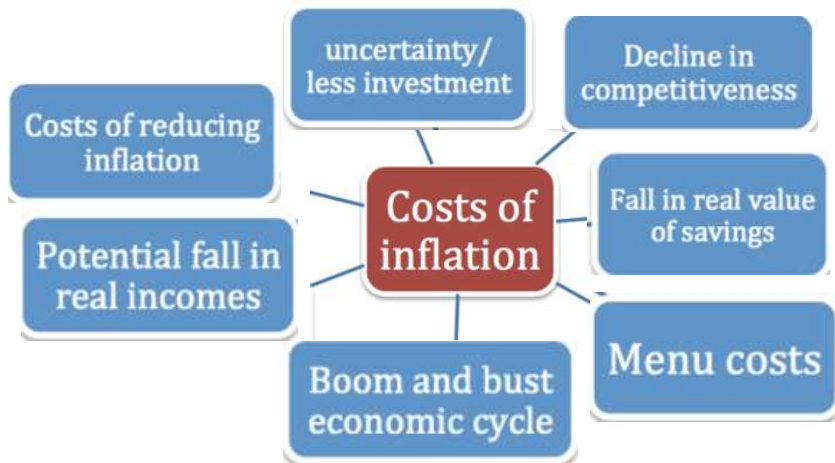
## Consumer Price Inflation in context



- Defined as a general increase in prices
- Inflation in the world has structurally fallen in the past 30 years
  - Change in focus of macro economic policy towards controlling inflation
  - Shift away from oil in industrial processes
  - Emergence of China as the world's marginal manufacturer
- Now, deflation in parts of the world – prices generally falling
  - Central banks printing money to try to prevent this

Source: World Bank

## Why is inflation a problem?



- Inflation imposes costs on an economy and society
- The risk of hyper-inflation
  - Hyper-inflation occurs when the inflation rate exceeds 50% per month
  - In Zimbabwe in 2008, inflation was estimated to be 79.6 billion % per month
  - Hyper-inflation can cause major social problems and political instability

"Lenin is said to have declared that the best way to destroy the capitalist system was to debauch the currency. By a continuing process of inflation governments can confiscate, secretly and unobserved, an important part of the wealth of their citizens." – John Maynard Keynes, (1919) *"The Economic Consequences of the Peace"* Chapter VI, pp. 235-236.

## Calculating inflation

- Inflation measured with the GDP deflator:
  - GDP deflator = Nominal GDP in a year/Real GDP in a year

$$P_t = \frac{\$Y_t}{Y_t}$$

- Note: This is an index number, and has no economic interpretation
- Example:
  - $\$Y_t = 110, Y_t = 100 \Rightarrow P_t =$

- Inflation rate at time  $t$  = % change in the GDP deflator

$$\pi_t = \frac{(P_t - P_{t-1})}{P_{t-1}}$$

- Example:
  - $P_t = 120, P_{t-1} = 100 \Rightarrow \pi_t =$

## Calculating inflation

- Inflation measured with the CPI index:
  - CPI index = index of all goods & services consumed in an economy, weighted by their importance

$$P_t = CPI_t$$

- Inflation rate at time  $t$  = % change in the CPI index

$$\pi_t = \frac{(CPI_t - CPI_{t-1})}{CPI_{t-1}}$$

- Example:

- $CPI_t = 105, CPI_{t-1} = 100 \Rightarrow \pi_t =$

## Exercise (from Blanchard Ch.2)

- Consider the following economy

	2009		2010	
	Quantity	Price	Quantity	Price
Cars	10	\$2,000	12	\$3,000
Computers	4	\$1,000	6	\$500
Oranges	1,000	\$1	1,000	\$1

- Calculate nominal GDP in 2009 and 2010 and the % growth rate

## Exercise (from Blanchard Ch.2)

- Consider the following economy

	2009		2010	
	Quantity	Price	Quantity	Price
Cars	10	\$2,000	12	\$3,000
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- Using 2009 prices, what is real GDP in 2009 and 2010, and what is its rate of growth?

## Exercise (from Blanchard Ch.2)

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3. Using 2010 prices, what is real GDP in 2009 and 2010, and what is its rate of growth?



## Exercise (from Blanchard Ch.2)

- Consider the following economy

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4. Why are the two growth rates different? Which of the two answers is the correct one?

## Exercise (from Blanchard Ch.2)

- Consider the following economy

	2009		2010	
	Quantity	Price	Quantity	Price
Cars	10	\$2,000	12	\$3,000
Computers	4	\$1,000	6	\$500
Oranges	1,000	\$1	1,000	\$1

5. Using 2009 prices for real GDP, compute the GDP deflator for 2009 and 2010 and use this to compute the rate of inflation in 2010

## Exercise (from Blanchard Ch.2)

- Consider the following economy

	2009		2010	
	Quantity	Price	Quantity	Price
Cars	10	\$2,000	12	\$3,000
Computers	4	\$1,000	6	\$500
Oranges	1,000	\$1	1,000	\$1

6. Using 2010 prices for real GDP, compute the GDP deflator for 2009 and 2010 and use this to compute the rate of inflation in 2010

## Exercise (from Blanchard Ch.2)

- Consider the following economy

	2009		2010	
	Quantity	Price	Quantity	Price
Cars	10	\$2,000	12	\$3,000
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7. Why are the two inflation rates different? Which of the two answers is the correct one?

## Exercise (from Blanchard Ch.2)

7. Calculate the Chain-Weighted GDP growth rate between 2009 and 2010. How does this compare to a simple average of the growth rates?