

# EF3441: Intermediate Macroeconomics

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Lecture 1

# The Syllabus

- Make sure to get and read the syllabus carefully!

# What is Macroeconomics

- The study of the behavior of ***large collections*** of economics agents.
- What type of questions does it try to answer?
  - What will GDP be one year from now?
  - How do economic fluctuations come about?
  - How does policy affect growth?
  - How should taxes and government debt be used?
- It is hard to do experiments in economics. We rely on models.

# Building a Model

- A theory written by an economist is simply a “model”.
- What is a model? A simple virtual representation of a real environment.
- Some examples:
  - Google maps and the world
  - A macroeconomic model and the Hong Kong economy
- What makes a good model?
  - It must be simple enough so that we can learn from it!

# The Issue of Realism

- Models, by definition, are simplified representations of reality.
- It is common for economic models to be criticized on the basis of being “unrealistic”.
- Should we be concerned about these type of critiques? If the “unrealistic” assumptions made in the model drastically changes the results: YES.
- If not, the model should not be evaluated on the basis of realism but on their predictive power.
- This approach is also common in the sciences: think for example the model that Newton considered when thinking of an apple falling from the tree.

# Model Ingredients

- Main ingredients
  - Households
  - Firms
  - Markets
  - Government
- Quantities:
  - Households: Consumption, Savings, Hours worked
  - Firm: Output
  - Markets: Wage, Prices, Inflation
  - Government: Taxes, Debt, Expenditures

# What Will You Get From This Course?

- Understand and perform simple forecasts of various measures of an aggregate economy's performance.
- Understand how aggregate macroeconomic behavior is affected by microeconomic behavior and equilibrium restrictions.
- Be able to answer simple macroeconomic policy questions by formulating a model, finding the data, and deriving an analytical answer.
- Understand the factors that cause economic growth and be able to describe the patterns of economic development over time.
- Understand how credit and labor frictions operate and how they might impact macroeconomic behavior.

# GDP

- **Three** alternative definitions/approaches to GDP
  - **Expenditure Approach**: Total spending on newly produced final goods and services produced within a nation during a year.
  - **Income Approach (national income)**: Total Income generated by newly produced final production goods and services, profits and taxes paid by firms and depreciation of capital within a nation during a year.
  - **Product Approach (value added)**: Market value of final goods and services newly produced within a nation during a year.
  - Use the symbol **Y** to denote *GDP* and **y** to denote *GDP per capita*.

# National Income Accounting Example

- Fictional Island Economy
- Coconut Producer, Restaurant, Consumers, Government

# Table 2.1

## Coconut Producer

| <b>Table 2.1</b> Coconut Producer |               |
|-----------------------------------|---------------|
| Total Revenue                     | \$20 million  |
| Wages                             | \$5 million   |
| Interest on Loan                  | \$0.5 million |
| Taxes                             | \$1.5 million |

## Table 2.2

### Restaurant

**Table 2.2** Restaurant

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

# Table 2.3

## After-Tax Profits

| Table 2.3 After-Tax Profits |              |
|-----------------------------|--------------|
| Coconut Producer            | \$13 million |
| Restaurant                  | \$11 million |

Profit = Revenue - Cost

Profit of coconut producer =  $20 - 5 - 0.5 - 1.5 = 13$

Profit of restaurant =  $30 - 12 - 4 - 3 = 11$

## Table 2.4

### Government

| <b>Table 2.4</b> Government |               |
|-----------------------------|---------------|
| Tax Revenue                 | \$5.5 million |
| Wages                       | \$5.5 million |

Tax revenue = 1.5 (coconut producer) + 3 (Restaurant) + 1.0 (Consumers) = 5.5

## Table 2.5

### Consumers

| <b>Table 2.5</b> Consumers       |                |
|----------------------------------|----------------|
| Wage Income                      | \$14.5 million |
| Interest Income                  | \$0.5 million  |
| Taxes                            | \$1 million    |
| Profits Distributed to Producers | \$24 million   |

Wage income = 5 (Coconut producer) + 4 (Restaurant) + 5.5 (Gov) = 14.5

Interest income = Interest of loan from coconut producer = 0.5

Profit Distributed to producers = 13 (Coconut producer) + 11 (restaurant) = 24

# The Island Economy

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## Coconut Producer

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

## Restaurant

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

## Government

|             |               |
|-------------|---------------|
| Tax Revenue | \$5.5 million |
| Wages       | \$5.5 million |

## Consumer

|                                    |                |
|------------------------------------|----------------|
| Wage Income                        | \$14.5 million |
| Interest Income                    | \$ 0.5 million |
| Taxes                              | \$ 1 million   |
| Profits Distributed from Producers | \$24 million   |

# The Island Economy

- The Expenditure Approach

- Determine all expenditure by each agent and add government expenditures:

$$\text{Total expenditures} = C + I + G + NX$$

- Note: in this example by definition  $NX = 0$
- Note: in our example some coconuts are sold to the restaurant some are sold directly.
- Note: government expenditures in our example are only
- for labor services, so consider wages as expenditure.

# The Expenditure Approach

- C:
  - 8 for buying coconut
  - 30 for buying meal
  - Total  $8+30 = 38$
- I: 0 (by assumption)
- G: 5.5
- NX: 0 (by assumption)
- $GDP = 38 + 5.5 = 43.5$

## Coconut Producer

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

## Restaurant

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

## Government

|             |               |
|-------------|---------------|
| Tax Revenue | \$5.5 million |
| Wages       | \$5.5 million |

## Consumer

|                                    |                |
|------------------------------------|----------------|
| Wage Income                        | \$14.5 million |
| Interest Income                    | \$ 0.5 million |
| Taxes                              | \$ 1 million   |
| Profits Distributed from Producers | \$24 million   |

# The Income Approach

- Determine all income for each agent:
  - For HH: wages (after taxes)+ profits from firms + interests;
    - Wages: **13.5** ( $5 + 4 + 5.5 - 1$ )
    - Profit: **24** ( $13 + 11$ )
    - Interests: **0.5**
    - **Total: 38**
  - For Government: taxes paid by HH and firms.
    - Taxes from HH: **1**
    - Taxes from firms: **4.5**
    - **Total: 5.5**
- **GDP =  $38 + 5.5 = 43.5$**

## Coconut Producer

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

## Restaurant

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

## Government

|             |               |
|-------------|---------------|
| Tax Revenue | \$5.5 million |
| Wages       | \$5.5 million |

## Consumer

|                                    |                |
|------------------------------------|----------------|
| Wage Income                        | \$14.5 million |
| Interest Income                    | \$ 0.5 million |
| Taxes                              | \$ 1 million   |
| Profits Distributed from Producers | \$24 million   |

# The Product Approach

- Determine the final product by determining the valued added of each firm and add government expenditures:
  - Note 1: the sum of value added equals the value of final products
  - Note 2: what is the valued added of the government? (use value of inputs)

- Coconut producer: 20
- Restaurant: 18 (30 – 12)
- Government: 5.5
- $GDP = 20 + 18 + 5.5 = 43.5$

## Coconut Producer

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

## Government

|             |               |
|-------------|---------------|
| Tax Revenue | \$5.5 million |
| Wages       | \$5.5 million |

## Restaurant

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

## Consumer

|                                    |                |
|------------------------------------|----------------|
| Wage Income                        | \$14.5 million |
| Interest Income                    | \$ 0.5 million |
| Taxes                              | \$ 1 million   |
| Profits Distributed from Producers | \$24 million   |

# Add in Inventory Investment

- Suppose everything else fixed, now the coconut producer produces \$26 million instead \$20 million, but only sell \$20 million (same as the previous problem: \$12 million to restaurant). What is GDP now?
- Answer: \$49.5 million.

# The Expenditure Approach

- C:
  - 8 for buying coconut
  - 30 for buying meal
  - Total  $8+30 = 38$
- I: **6**
- G: 5.5
- NX: 0 by assumption
- $GDP = 38 + \mathbf{6} + 5.5 = 49.5$

# The Income Approach

- Determine all income for each agent:
  - For HH: wages (after taxes)+ profits from firms + firms' inventory + interests;
    - Wages: 13.5 (5 + 4 + 5.5 – 1.0)
    - Profit: 24.0 (13.0+11.0)
    - firms' investment : 6.0
    - Interests: 0.5
    - Total: 44.0
  - For Government: taxes paid by HH and firms.
    - Taxes from HH: 1.0
    - Taxes from firms: 4.5
    - Total: 5.5
- $GDP = 44.0 + 5.5 = 49.5$

# The Product Approach

- Determine the final product by determining the valued added of each firm and add government expenditures:
  - Note 1: the sum of value added equals the value of final products
  - Note 2: what is the valued added of the government? (use value of inputs)
- Coconut producer: 26
- Restaurant: 18 (30-12)
- Government: 5.5
- $GDP = 26 + 18.0 + 5.5 = 49.5$

# Problems in Measuring GDP

- Economic activity in the *underground economy* cannot be measured directly – this activity might be measured indirectly by accounting for the use of currency.
- Government production is difficult to measure, as the output (for example defense services) is typically not sold in the market.

# Nominal and Real GDP and Price Indices

- Price Index: Weighted average of a set of observed prices that gives a measure of the *price level*.
- Price indices allow us to measure the *inflation rate* – the rate of change in the price level.
- A measure of the inflation rate allows us to determine how much of an increase in GDP is *nominal* and how much is *real*.

Table 2.10 Data for Real GDP Example

|                    | <b>Apples</b>    | <b>Oranges</b>   |
|--------------------|------------------|------------------|
| Quantity in Year 1 | $Q_1^a = 50$     | $Q_1^o = 100$    |
| Price in Year 1    | $P_1^a = \$1.00$ | $P_1^o = \$0.80$ |
| Quantity in Year 2 | $Q_2^a = 80$     | $Q_2^o = 120$    |
| Price in Year 2    | $P_2^a = \$1.25$ | $P_2^o = \$1.60$ |

# Nominal GDP

| Product/Time | Year 1 | Year 2 |
|--------------|--------|--------|
| Apples       | 50     | 80     |
| Oranges      | 100    | 120    |
| Prices       |        |        |
| Apples       | \$1.00 | \$1.25 |
| Oranges      | \$0.80 | \$1.60 |
| Values       |        |        |
| Apples       | \$50   | \$100  |
| Oranges      | \$80   | \$192  |
| Nominal GDP  | \$130  | \$292  |

- Nominal GDP growth rate =  $(292 - 130) * 100\% / 130 = 125\%$

# Chain-Weighted Real GDP: Laspeyres Growth Rate

| Product/Time | Year 1 | Year 2                   |
|--------------|--------|--------------------------|
| Apples       | 50     | 80                       |
| Oranges      | 100    | 120                      |
| Prices       |        |                          |
| Apples       | \$1.00 | <del>\$1.25</del> \$1.00 |
| Oranges      | \$0.80 | <del>\$1.60</del> \$0.80 |
| Values       |        |                          |
| Apples       | \$50   | \$80                     |
| Oranges      | \$80   | \$96                     |
| Real GDP     | \$130  | \$176                    |

- Real GDP growth rate ( $g_L$ ) =  $(176-130)*100\%/130 = 35.4\%$

# Chain-Weighted Real GDP: Paasche Approach

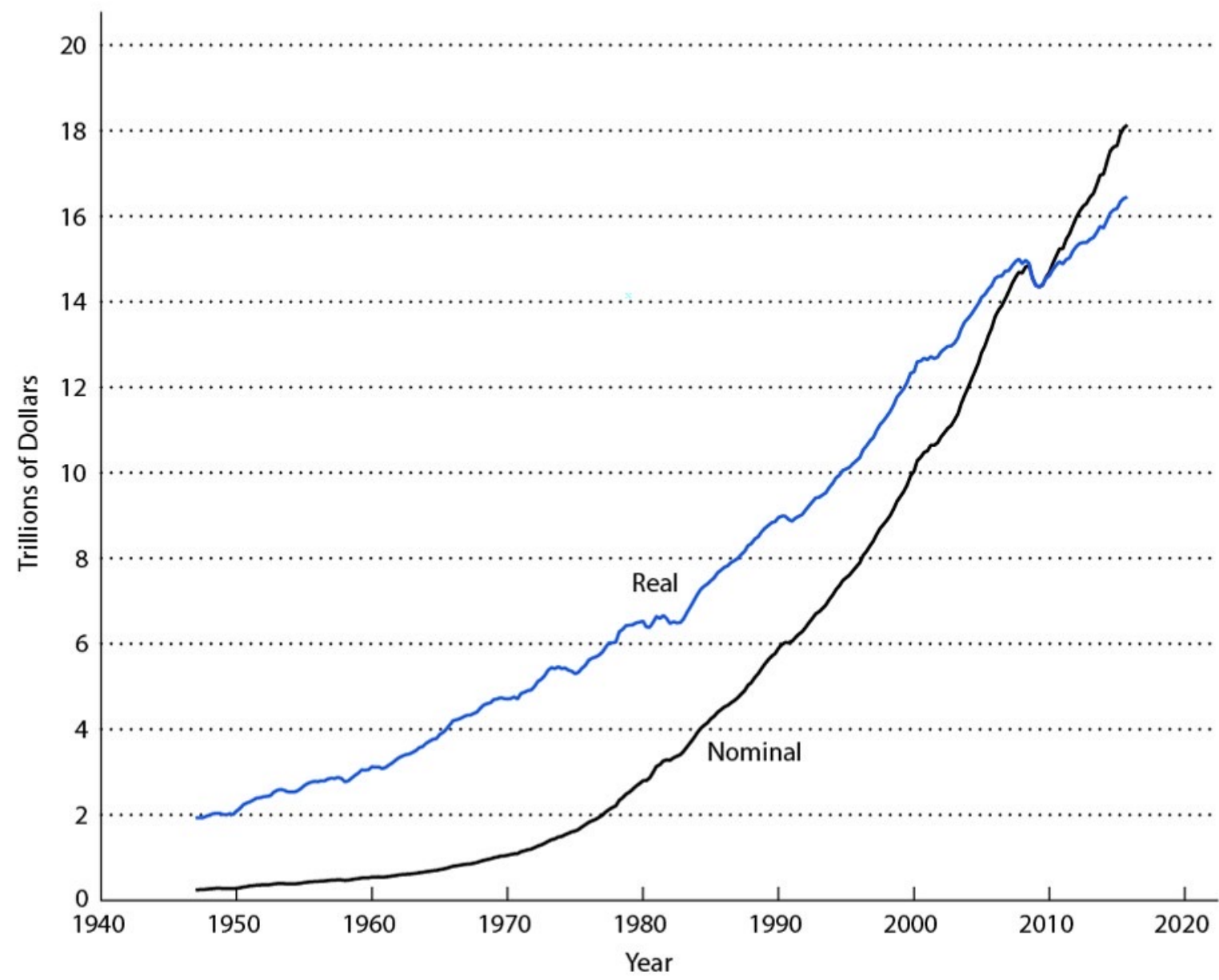
| Product/Time | Year 1                   | Year 2 |
|--------------|--------------------------|--------|
| Apples       | 50                       | 80     |
| Oranges      | 100                      | 120    |
| Prices       |                          |        |
| Apples       | <del>\$1.00</del> \$1.25 | \$1.25 |
| Oranges      | <del>\$0.80</del> \$1.60 | \$1.60 |
| Values       |                          |        |
| Apples       | \$62.5                   | \$100  |
| Oranges      | \$160.                   | \$192  |
| Real GDP     | \$222.5                  | \$292  |

- Real GDP growth rate ( $g_p$ ) =  $(292 - 222.5) * 100\% / 222.5 = 31.2\%$

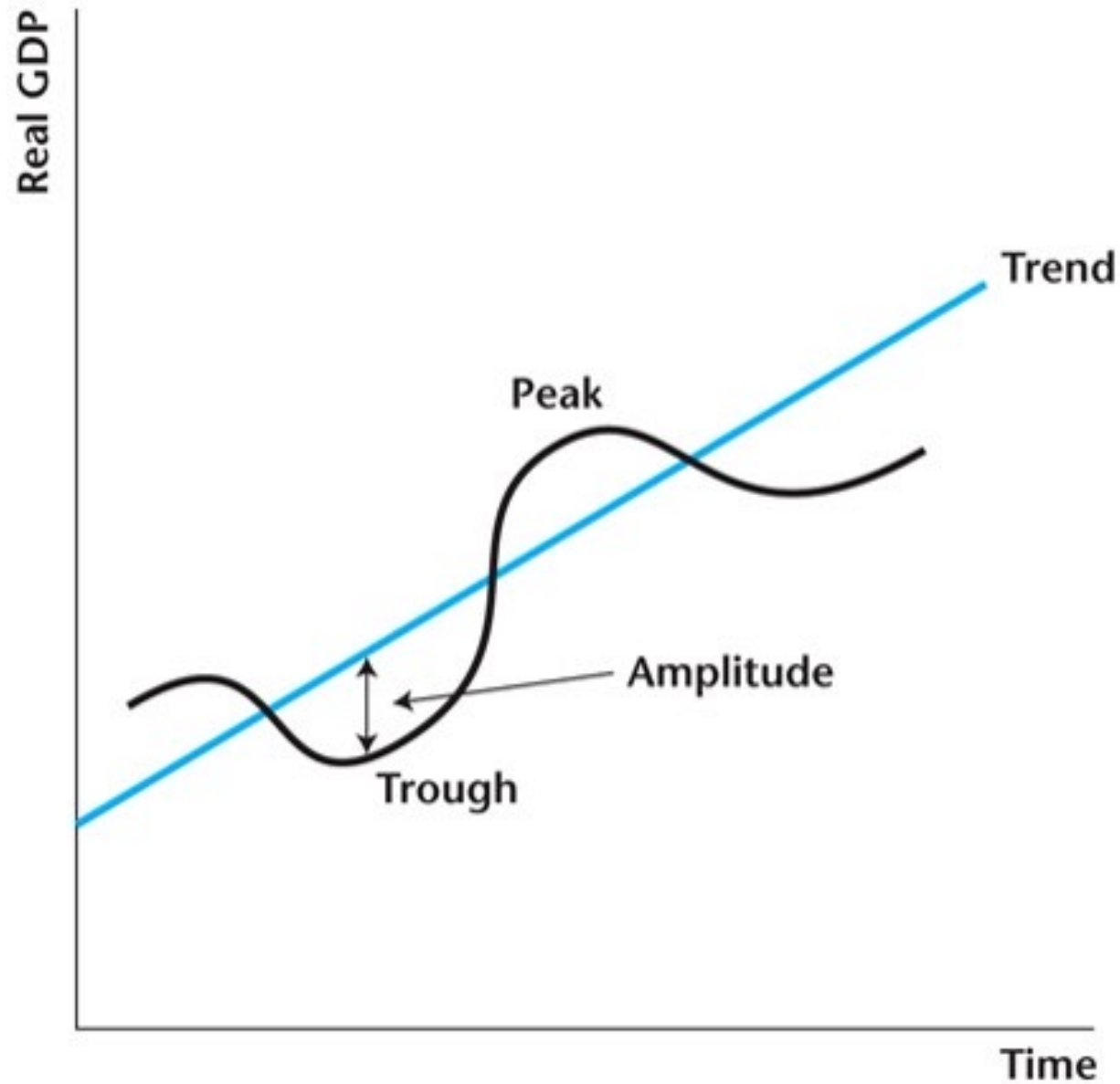
# Chain-Weighted Real GDP

- Fisher Ideal Index: geometric mean:  $((1 + g_L) * (1 + g_p))^{0.5}$
- Implicit GDP price deflator =  $\text{Nominal GDP} * 100 / \text{Real GDP}$

Figure 2.1 Nominal GDP and Chain-Weighted Real GDP



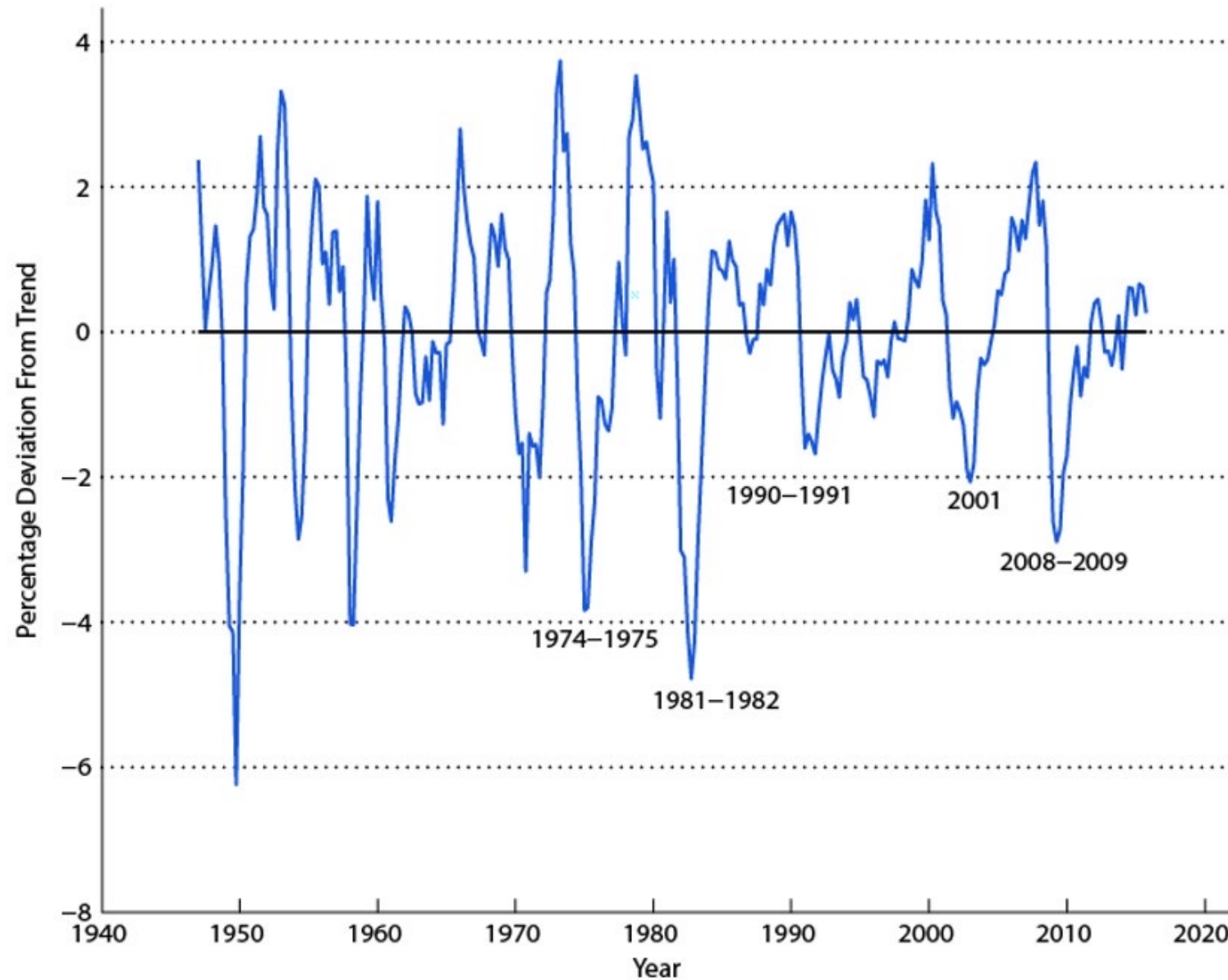
# Figure 3.1: Idealized Business Cycles



# Deviations From Trend in Real GDP are Irregular

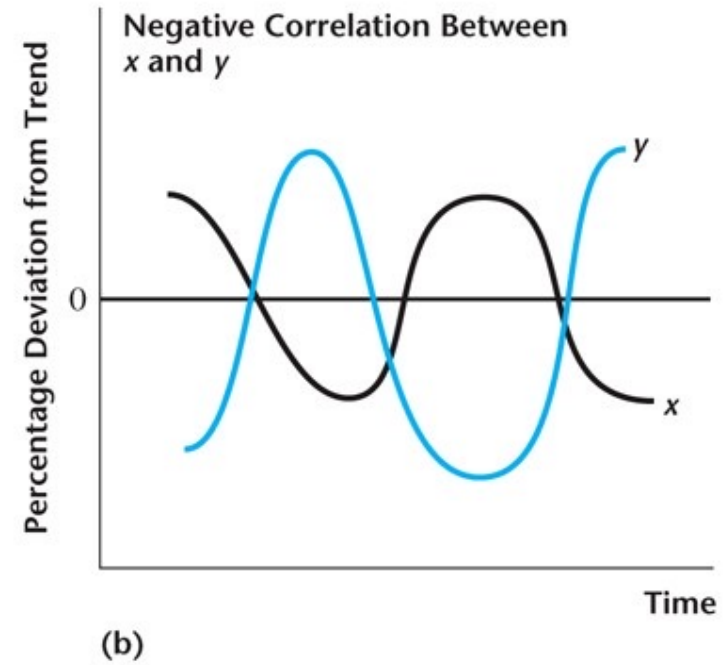
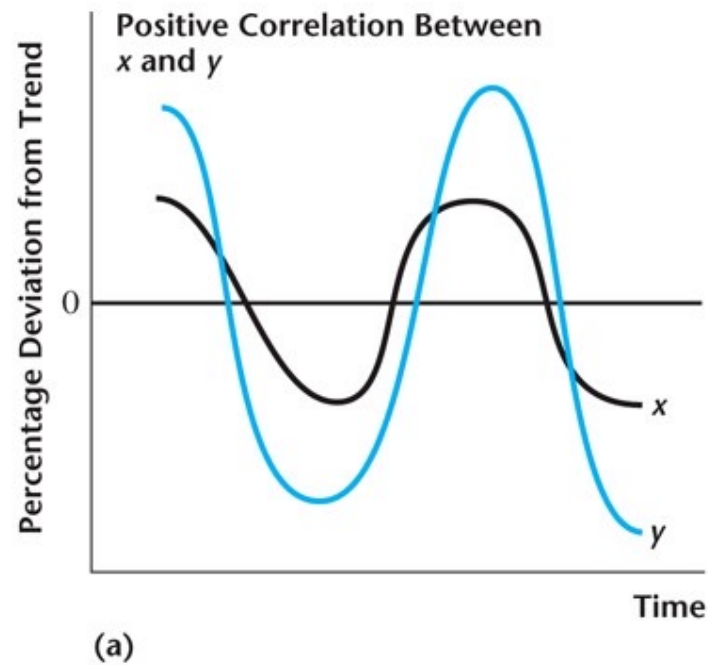
- The fluctuations in GDP about trend are quite choppy.
- There is no regularity in the amplitude of fluctuations in real GDP about trend.
- There is no regularity in the frequency of fluctuations in real GDP about trend.

Figure 3.2: Percentage Deviations from Trend in Real GDP



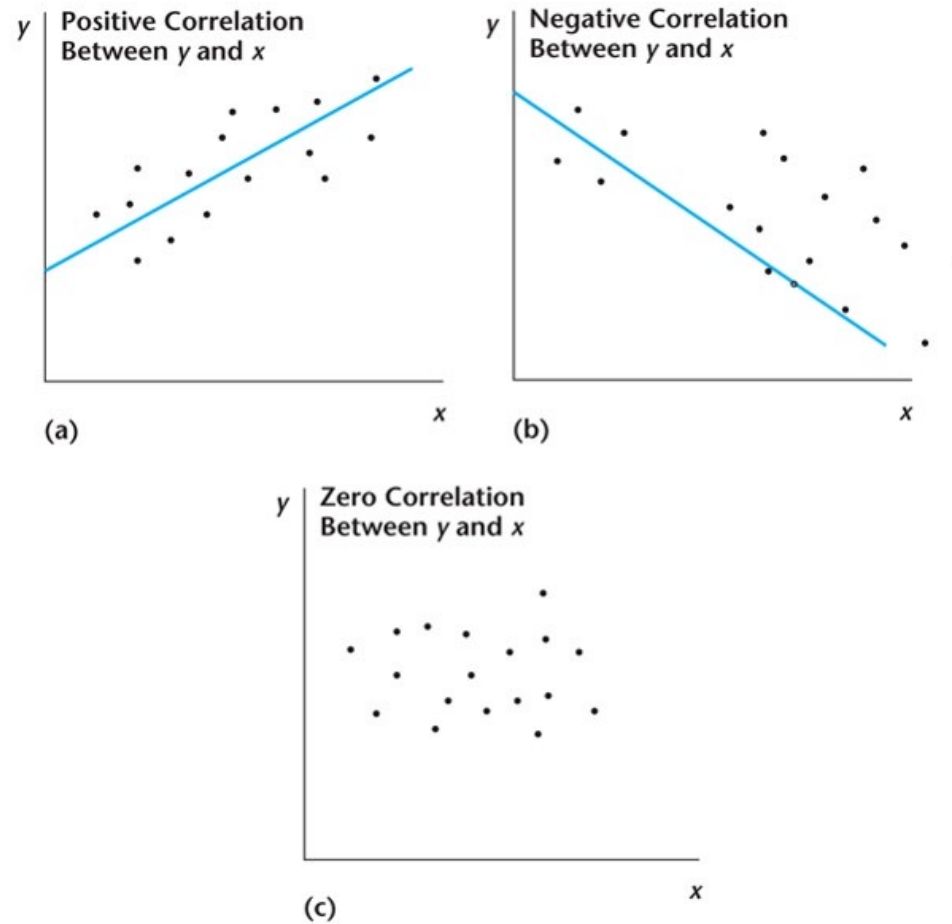
# Figure 3.3

## Time Series Plots of $x$ and $y$



# Figure 3.4

## Correlations Between Variables $y$ and $x$



# Correlation with Real GDP

- If the deviations from the trend in a macroeconomic variable are positively (negatively) correlated with the deviations from the trend in *real GDP*, then that variable is *procyclical* (*countercyclical*).
- If a macroeconomic variable is neither *procyclical* nor *countercyclical*, it is *acyclical*.

Figure 3.9 Percentage Deviations from Trend in Real Consumption and Real GDP

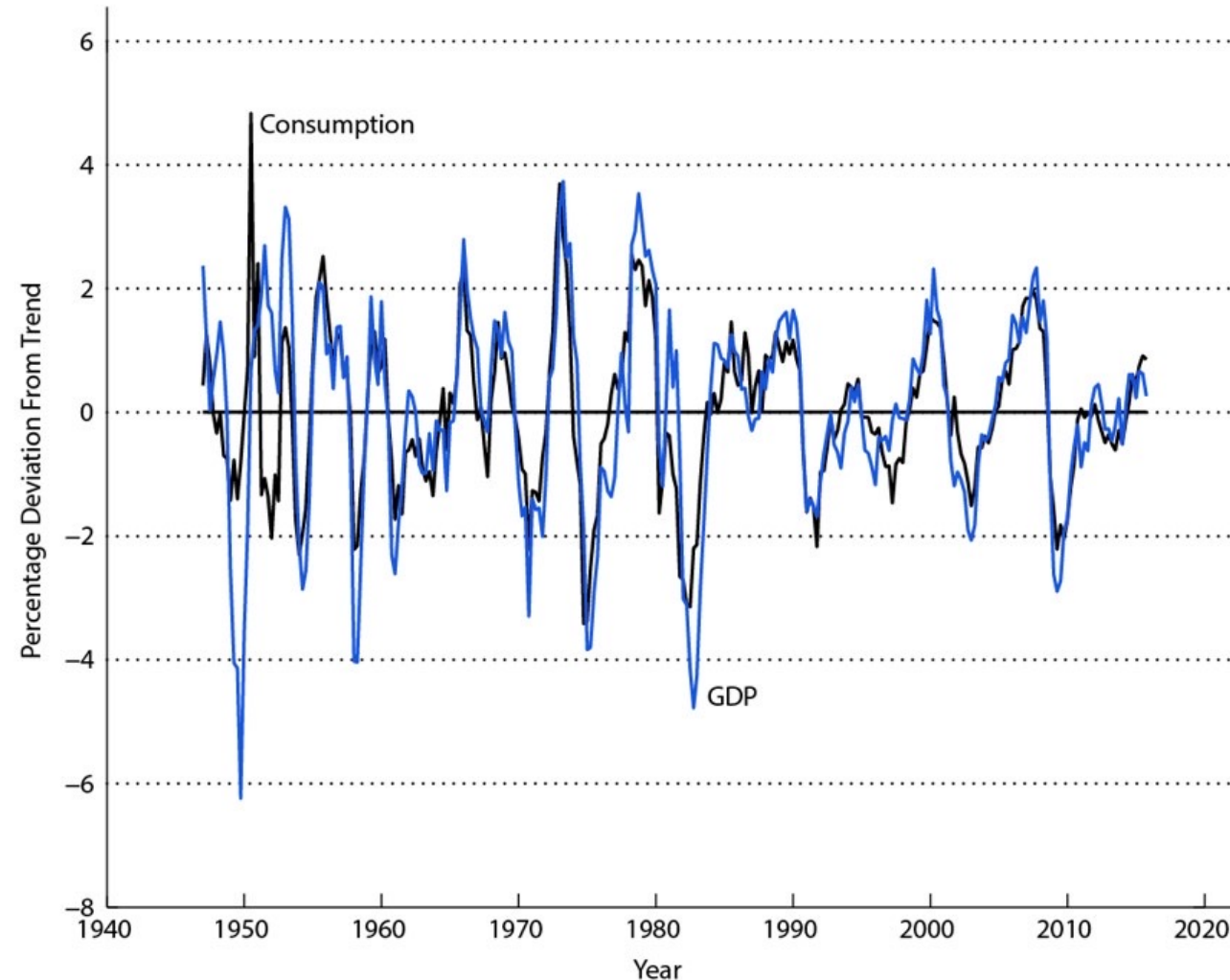


Figure 3.10 Percentage Deviations from Trend in Real Investment and Real GDP

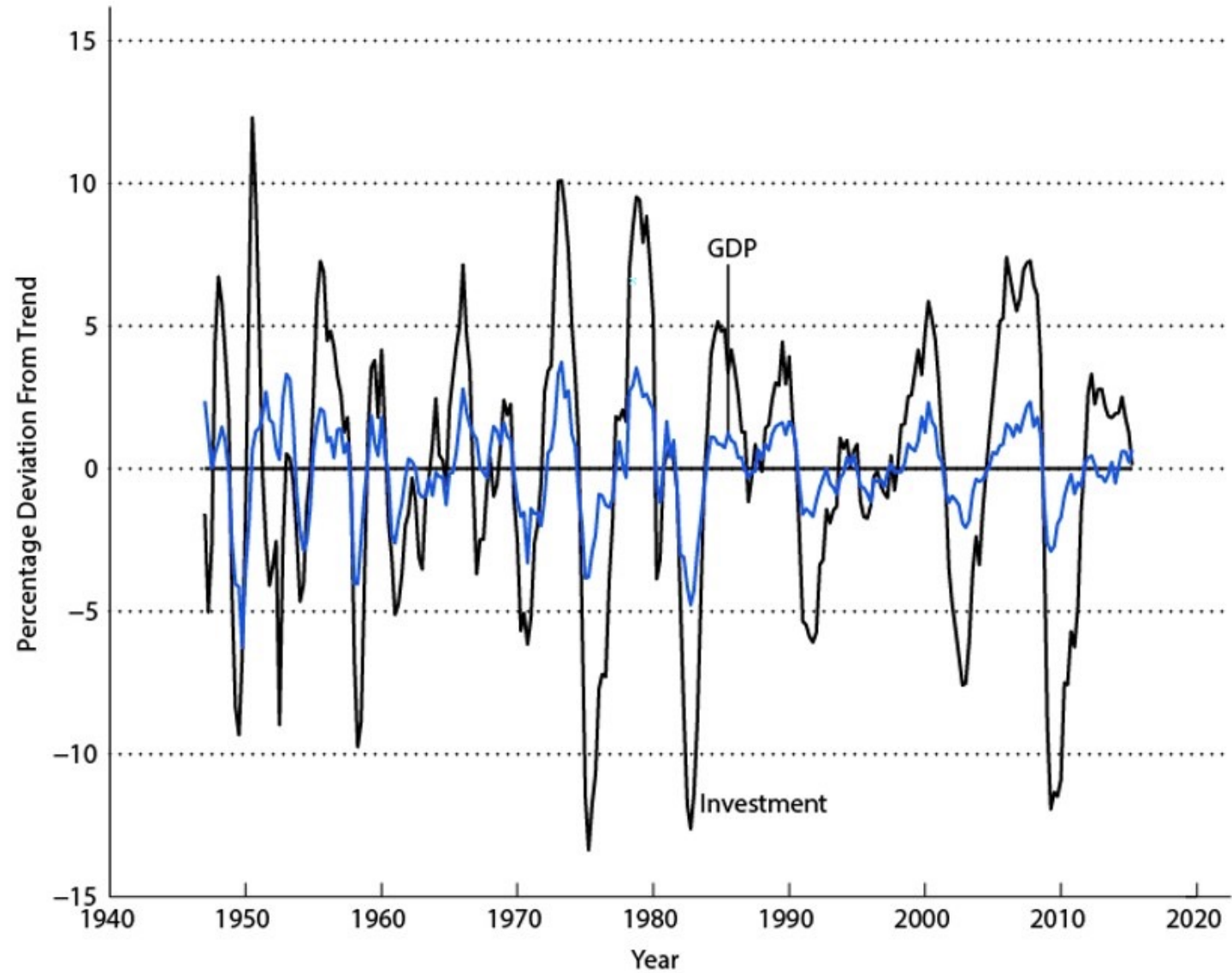


Figure 3.11 Percentage Deviations From Trend in the Price Level and Real GDP

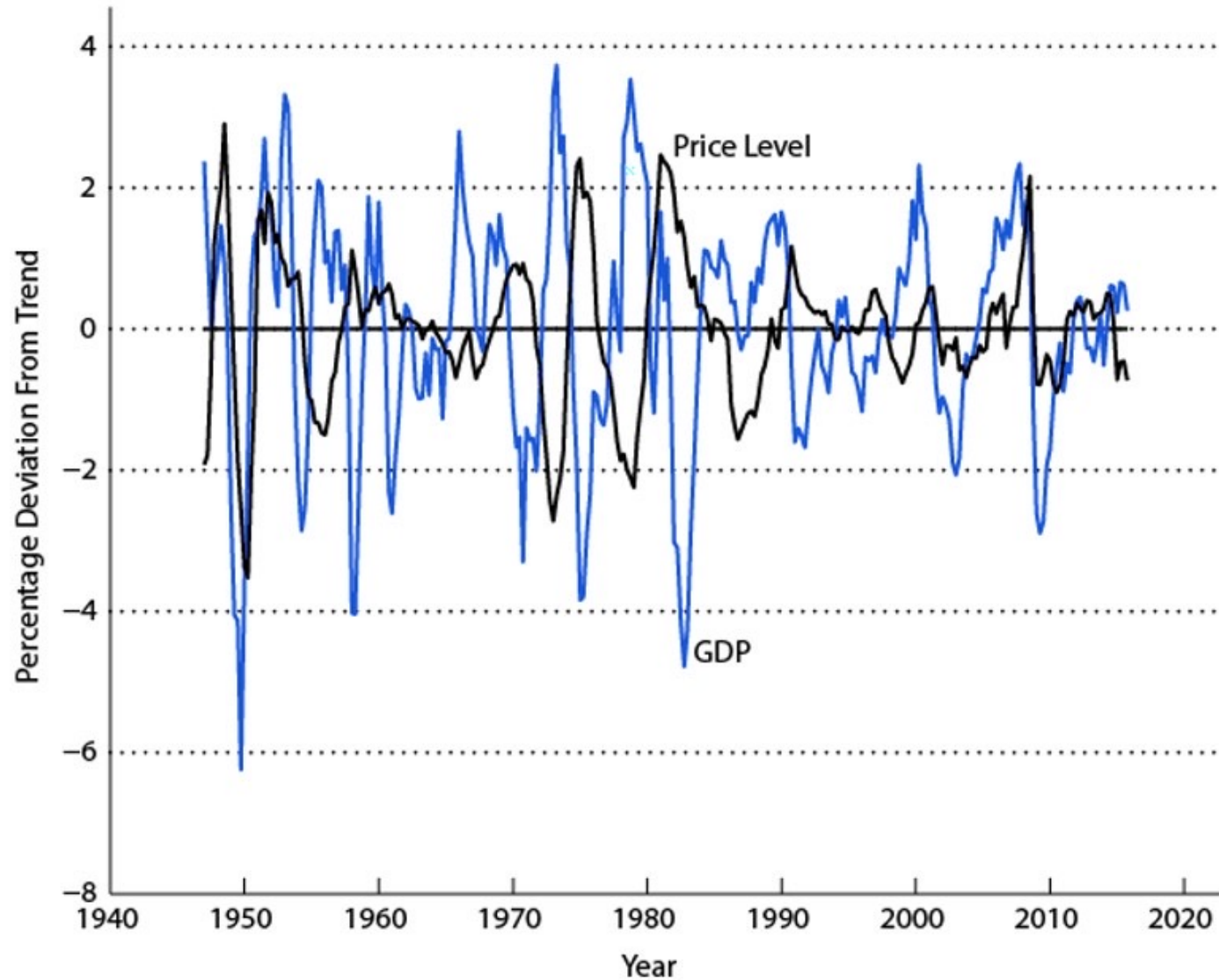


Figure 3.12 The Inflation Rate and GDP

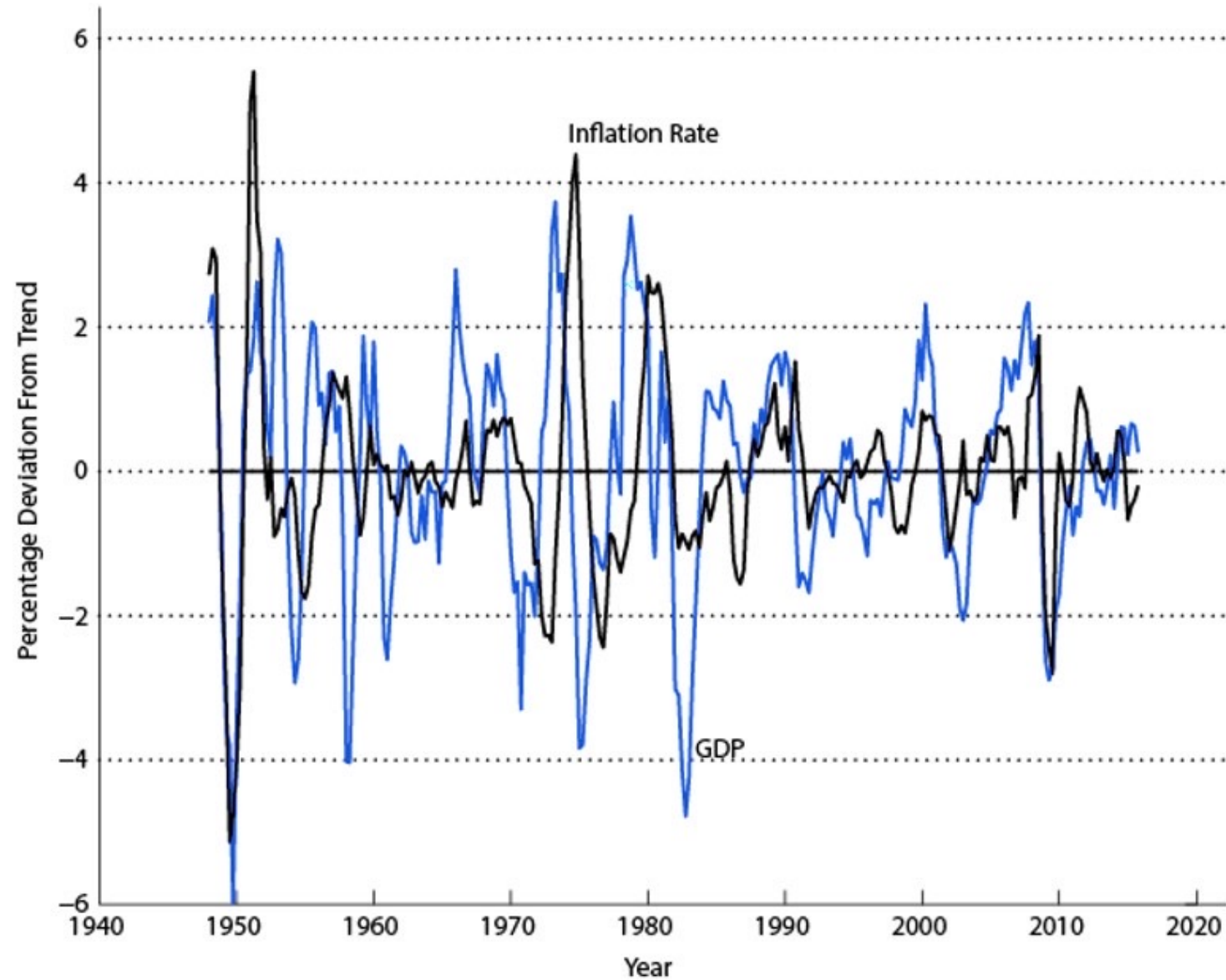


Figure 3.13 Percentage Deviations from Trend in Employment and Real GDP

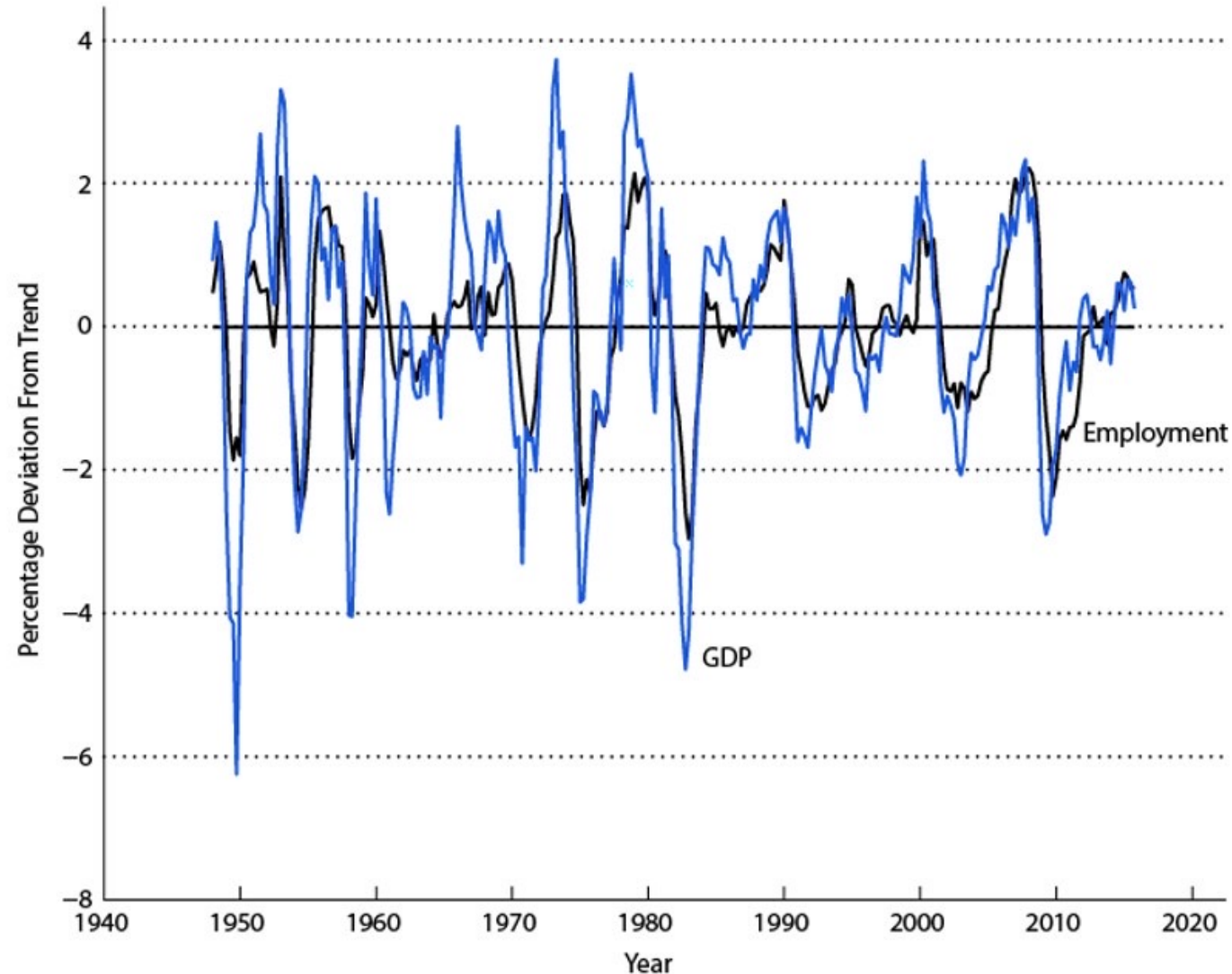
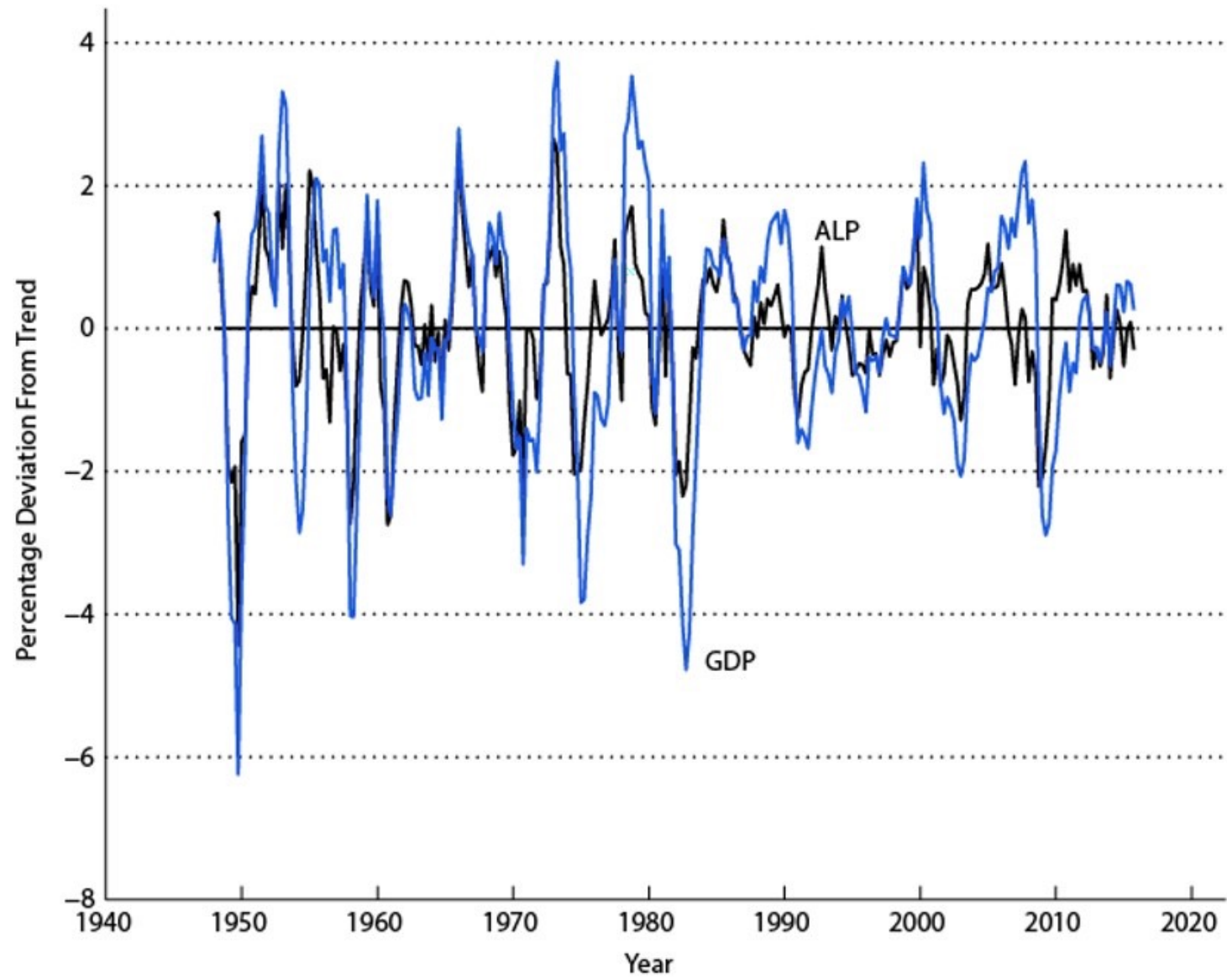


Figure 3.14 Percentage Deviations from Trend in Average Labor Productivity and Real GDP



# Model vs. Data

- One of the main goals of this course is to build useful models that can qualitatively, but not quantitatively, match the data.
  - The model's foundation starts with some basic microeconomic principles concerning the behavior of consumers and firms.
- We then rely on these models to do policy analysis.