

Time series analysis

Lecture 12. Hypothesis testing on rational expectations.

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What is Macroeconomics?

- The study of the behavior of LARGE COLLECTIONS (**AGGREGATION**) of economic agents.
- Use economic MODELS to study *long-run growth* and *business cycles*

Aggregation: GNP, Economic Growth, and Business Cycles

- GNP: Adjustments for Inflation (real) and Population Growth (per capita)
- Historical Growth Perspectives
- The Great Depression and World War II: Business Cycles
- Growth Measurement
- Trend and Cyclical Components

Figure 1 Per Capita Real GNP (in 1996 dollars) for the United States, 1900--2002

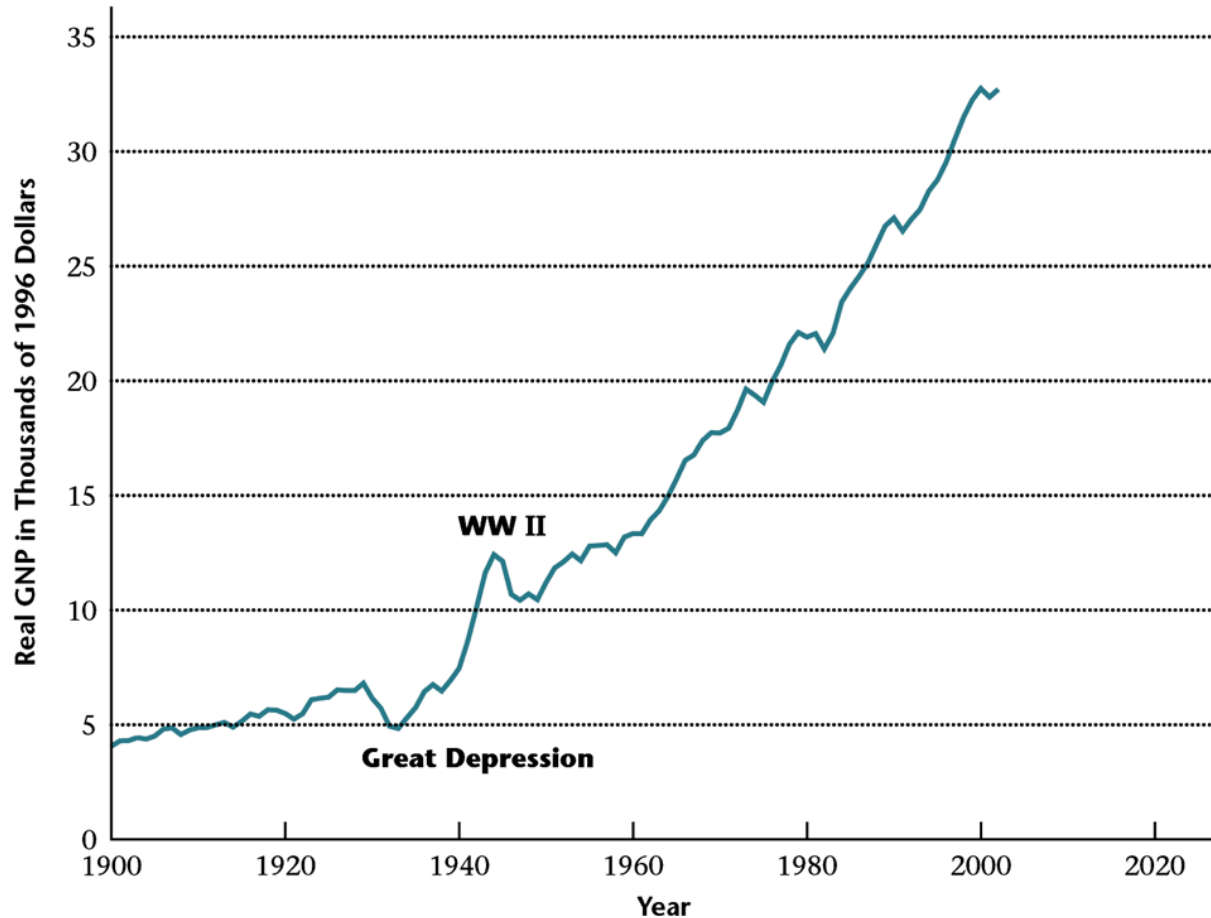


Figure 2 Natural Logarithm of Per Capita Real GNP

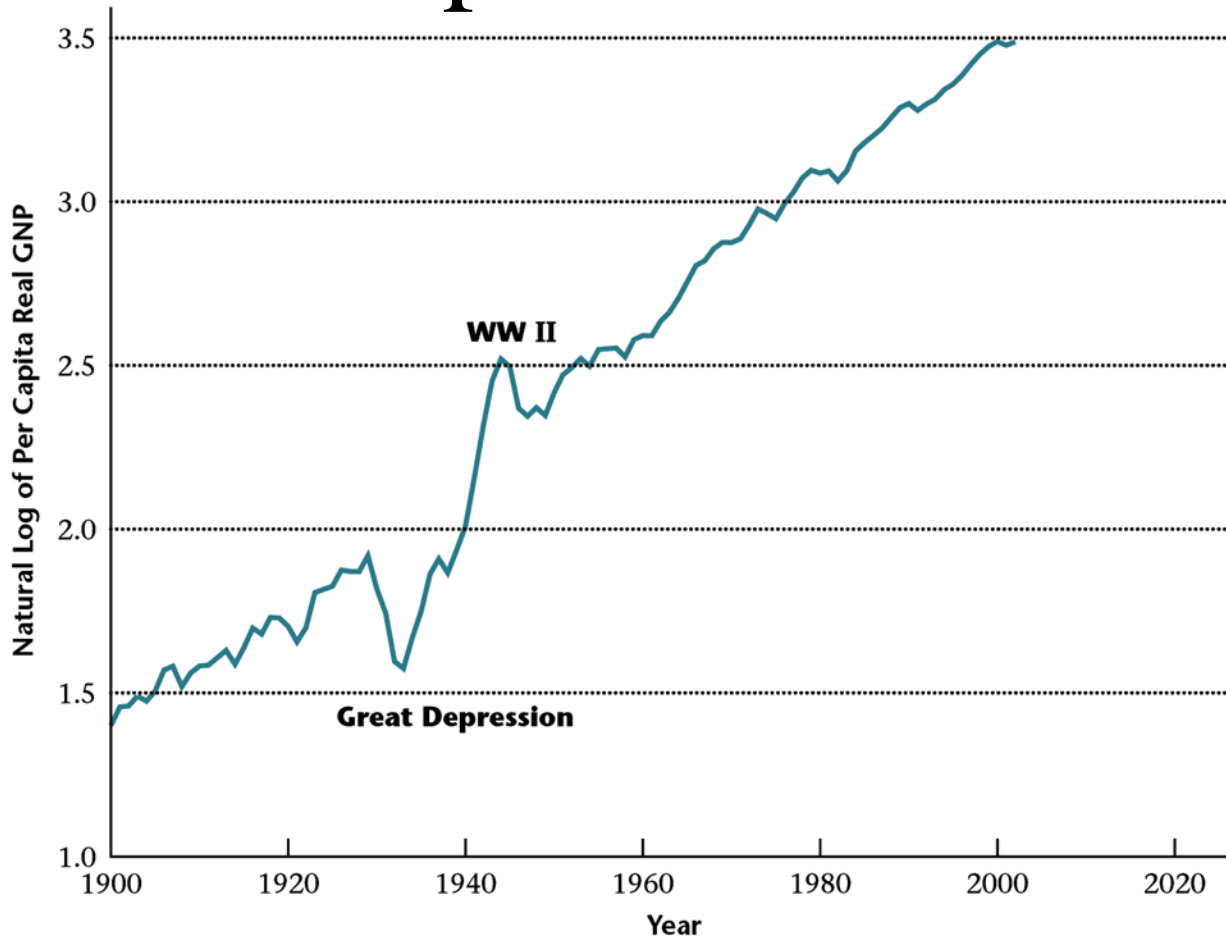


Figure 3 Natural Logarithm of Per Capita Real GNP and Trend

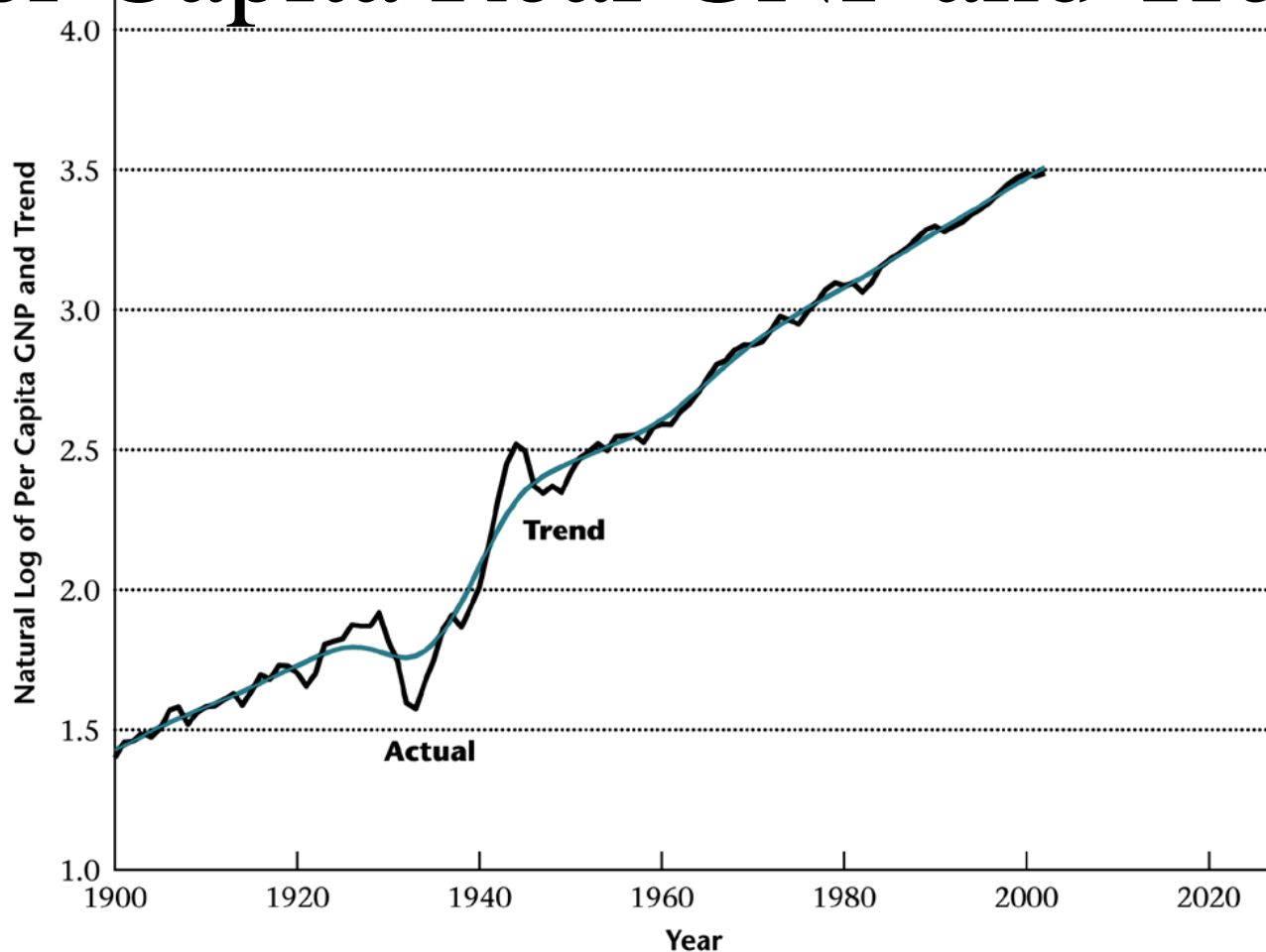
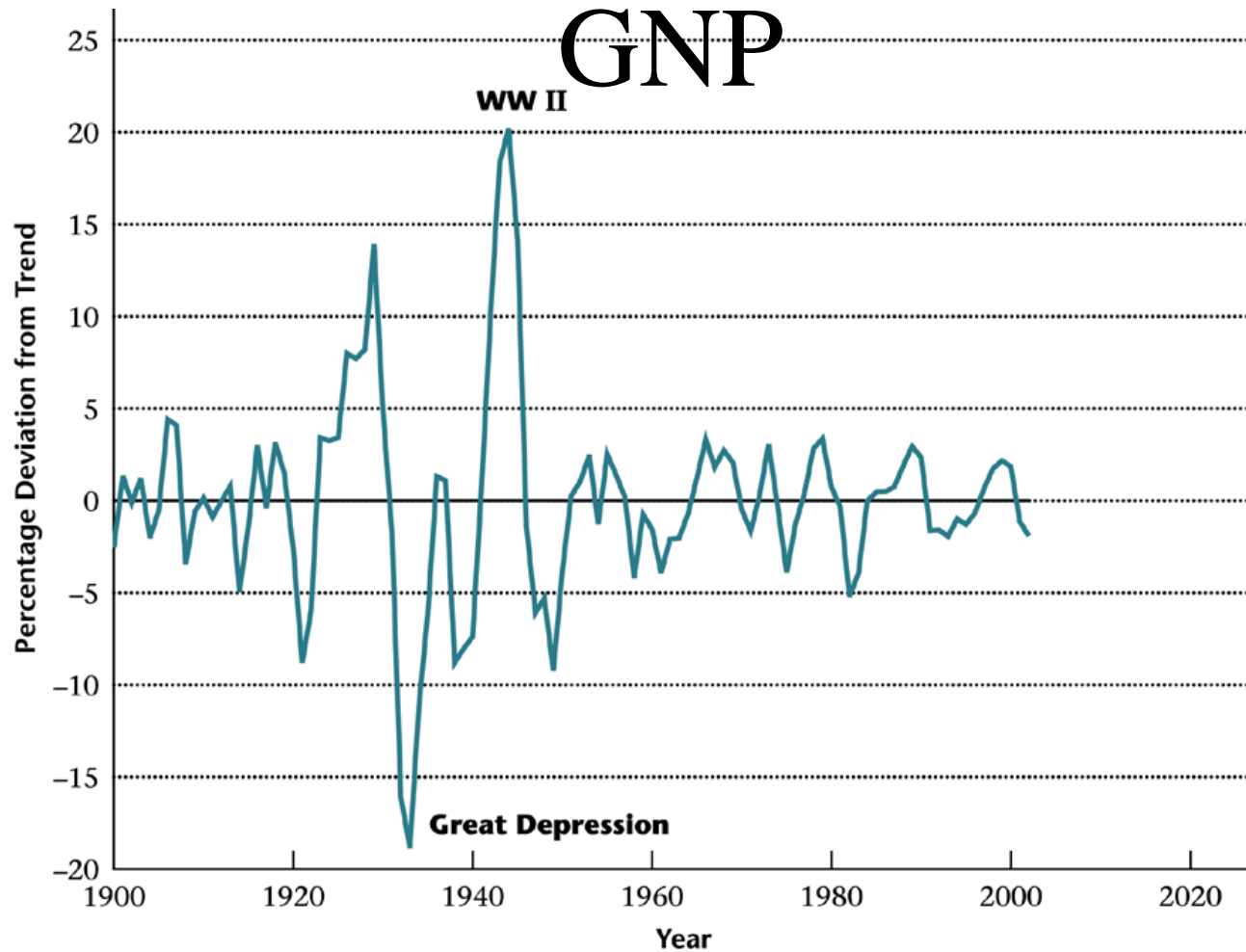


Figure 4 Percentage Deviations from Trend in Per Capita Real GNP



Macroeconomic Models

- It is hard to do experiments in economics.
We rely on **MODELS**.
- The basic structure of a macroeconomic model
 - Players: Consumers and firms
 - Goods: for consumption (and investment)
 - Preferences

- Technology: for firms to produce goods
 - Resources
- Rational Behavior: Optimization
- Competitive Equilibrium: price-taking, market clearing
- Hypotheses and Hypothesis Testing

Microeconomic Principles: Why we cannot ignore them

- When do Microeconomic Reactions affect Macroeconomic Outcomes?
 - Policy change
- Rational Expectations and the Lucas Critique
 - Macroeconomic policy analysis could be done in a sensible way only if microeconomic behavior is taken seriously

Disagreement in Macroeconomics

- Exogenous and Endogenous Growth Models (Cp. 6, 7): generally accepted
- Business Cycle theory (Cp. 11, 12) is another story
 - Keynesian Sticky-Price Models
 - Money Surprise Theory
 - Real Business Cycle (RBC) Models
 - Keynesian Coordination Failure Models

Outline: What Do We Learn from Macro?

- Fundamentals: Preferences and Productive Capacity (Cp. 4, 5)
- The Efficiency of Market Outcomes: “Invisible Hand” (Cp. 5)
- The Cost of Government Activities: Tax cut is not a free lunch. (Cp. 8)
- Expectations matter (Cp. 8, 9)

What Do We Learn from Macro?

- Technological Progress brings about long-run growth (Cp. 6, 7)
- Money Neutrality (Cp. 10, 15)
- International trade could be a source of shocks to the domestic economy. (Cp. 13, 14)
- In the long-run, inflation is caused by growth in the money supply. (Cp. 15)

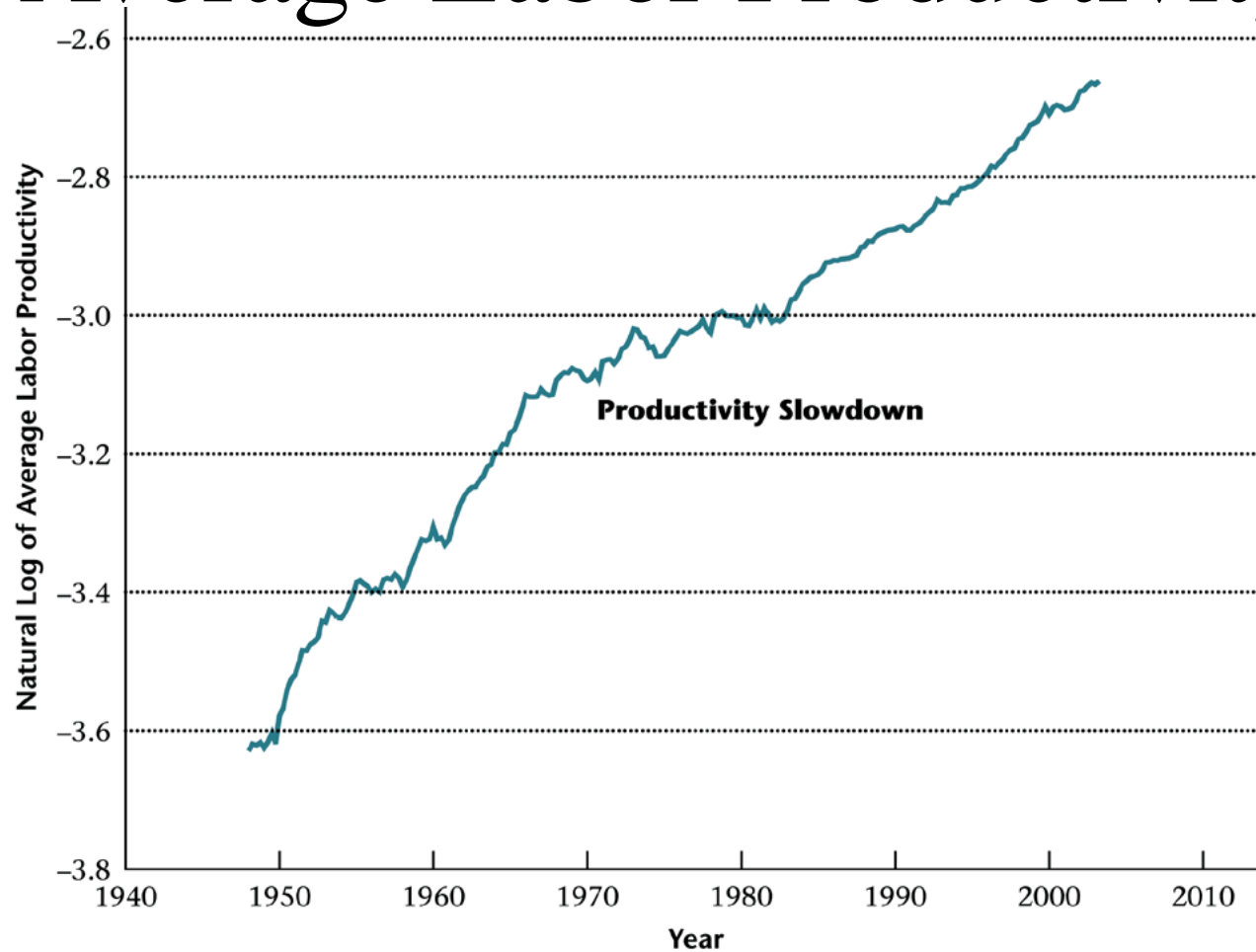
What Do We Learn from Macro?

- Business Cycles are remarkably similar, but they can have different causes (Cp. 11, 12)
- Unemployment can be a valuable use of time: search theory (Cp. 16)

Understanding Current and Recent Macroeconomic Events

- The Productivity Slowdown
 - Average Labor Productivity
 - The Slowdown: Late 1960's-early 1980's
 - Measurement Error?
 - Adjustment to New Technology?

Figure 5 Natural Logarithm of Average Labor Productivity



- Taxes, Government Spending, and the Government Deficit
 - The Upward Trend in the Size of Government
 - Crowding out the Private Sector activity
 - The Deficit and Government Savings
 - Ricardian Equivalence

Figure 6 Total Taxes (black line) and Total Government Spending (colored line) in the United States, as Percentages of GDP

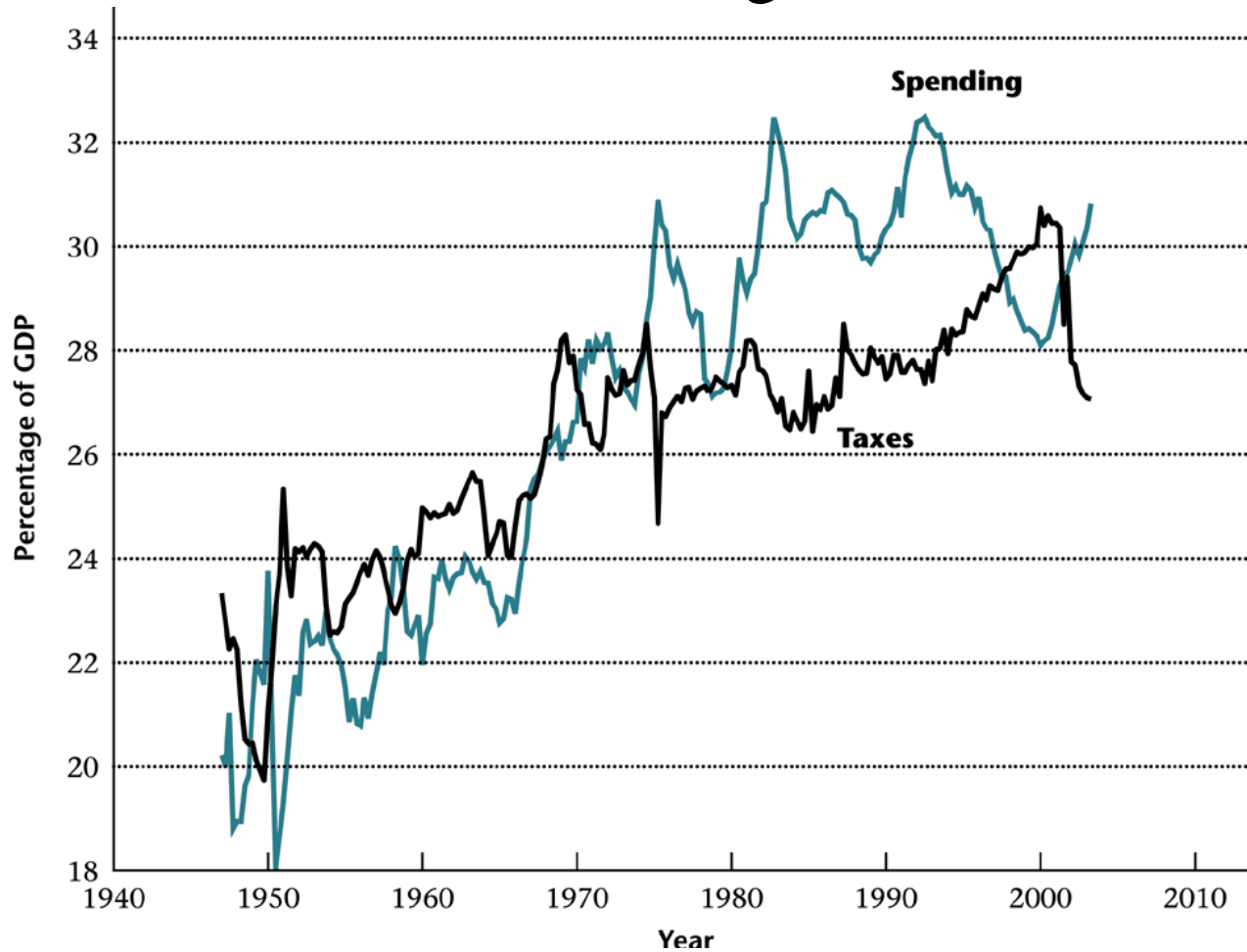
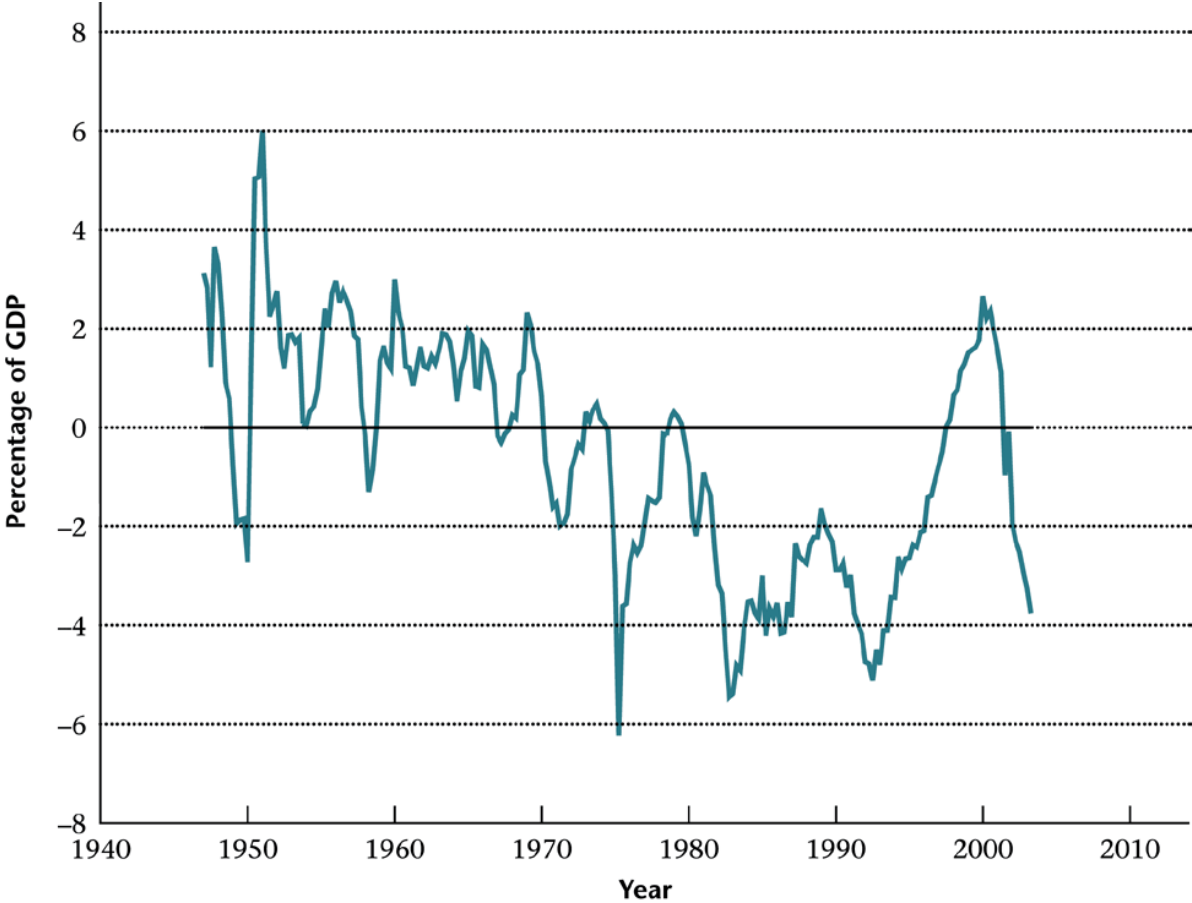


Figure 7 The Total Government Surplus in the United States as a Percentage of GDP



- Interest Rates

- The Nominal Interest Rate and the Real Interest Rate

- Inflation and Nominal Interest Rates

Fisher Equation:

nominal r = real r + inflation rate

Figure 8 The Nominal Interest Rate and the Inflation Rate

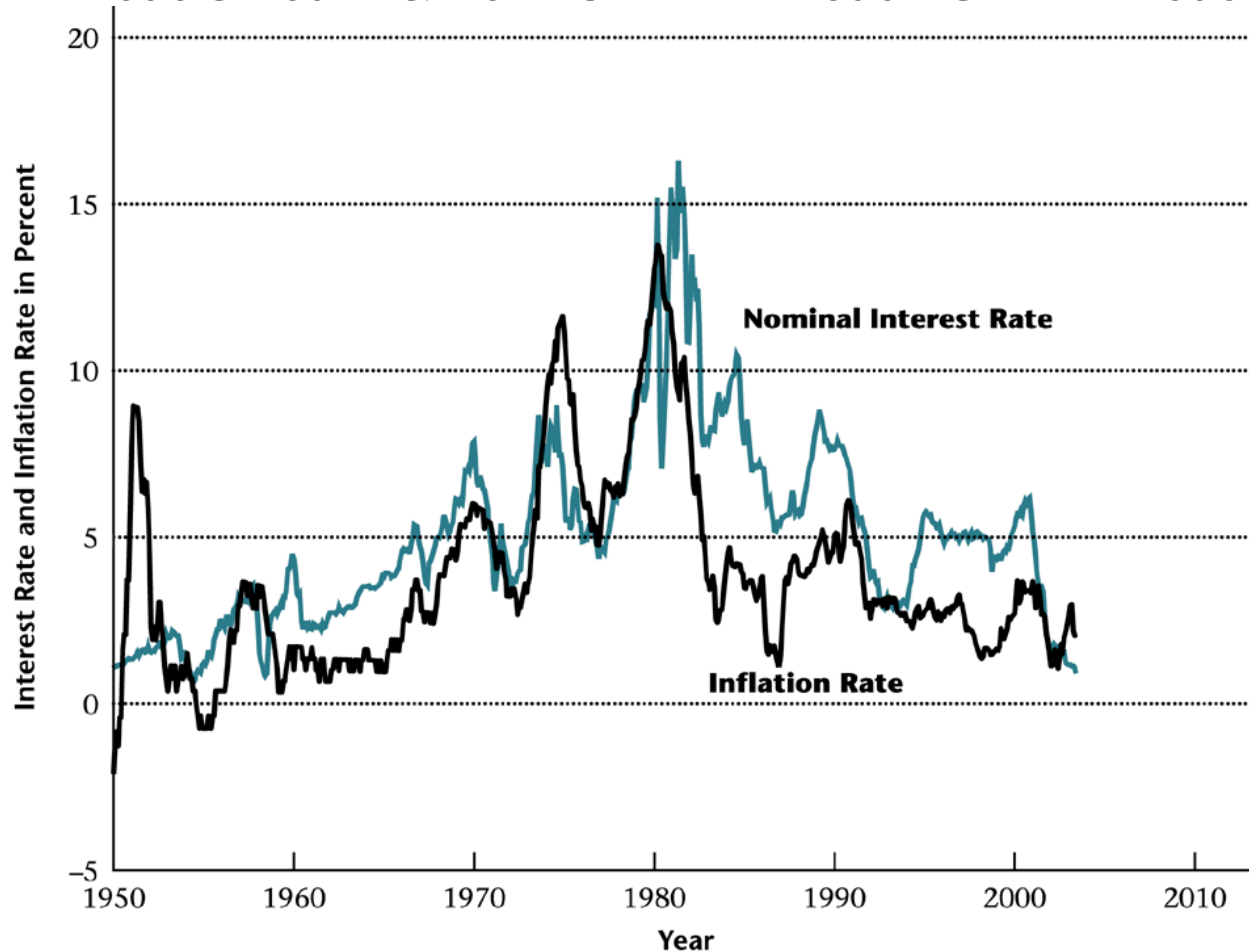
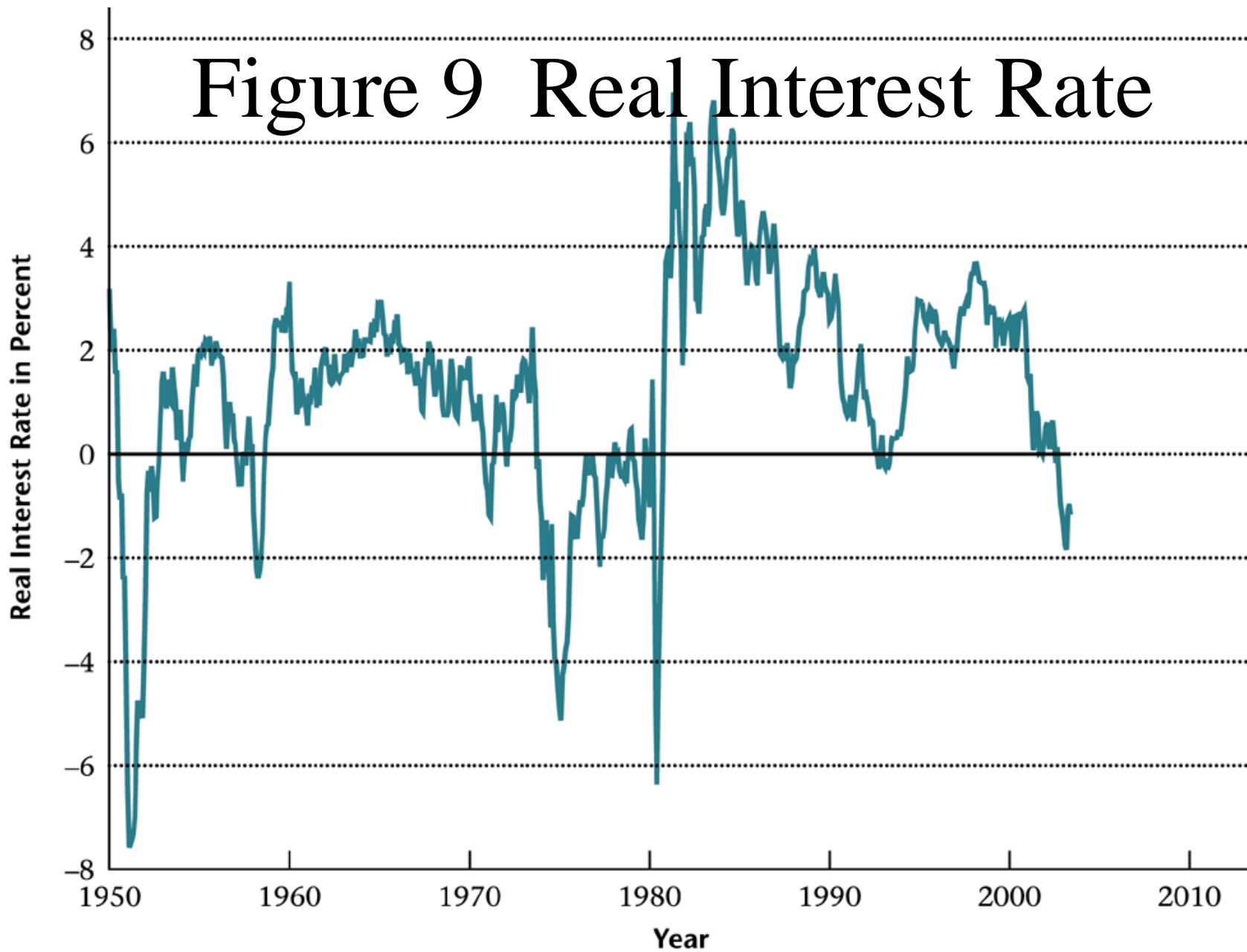
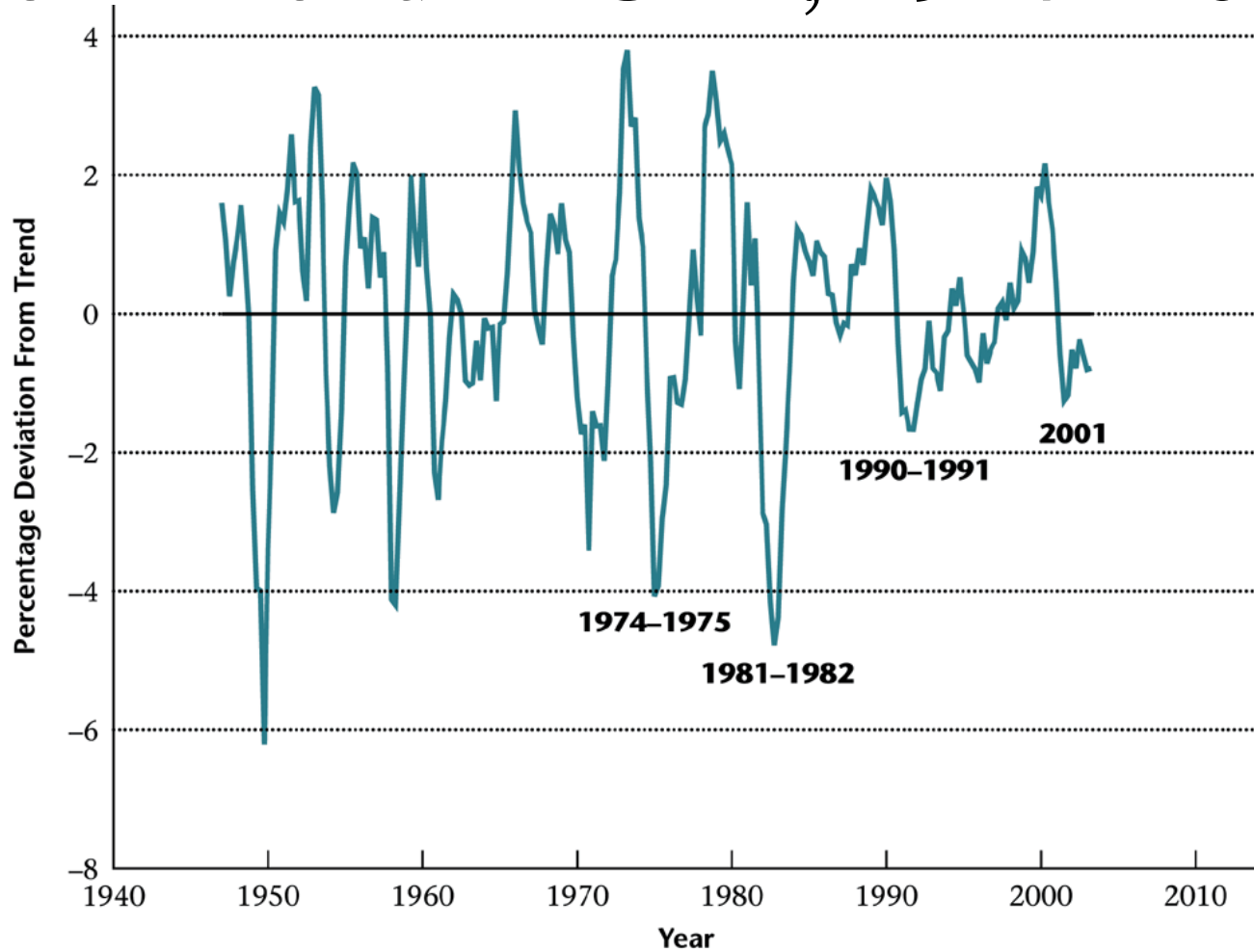


Figure 9 Real Interest Rate



- Business Cycles in US
 - Oil Shocks: 1974, 1979
 - Contractionary Monetary policy: 1981-1982
 - Possible increase in oil prices during the Gulf War: 1990-1991
 - IT bust and terrorist attack: 2001
 - Subprime Crisis leads to Financial Meltdown: 2008-

Figure 10 Percentage Deviations from Trend in GDP, 1947–2003



- Trade and the Twin Deficits of the 1980's
 - The Current Account and International Financial Transactions
 - Current Account Deficits and Government Budget Deficits

Figure 1.11 Exports and Imports of Goods and Services for the United States as Percentages of GDP

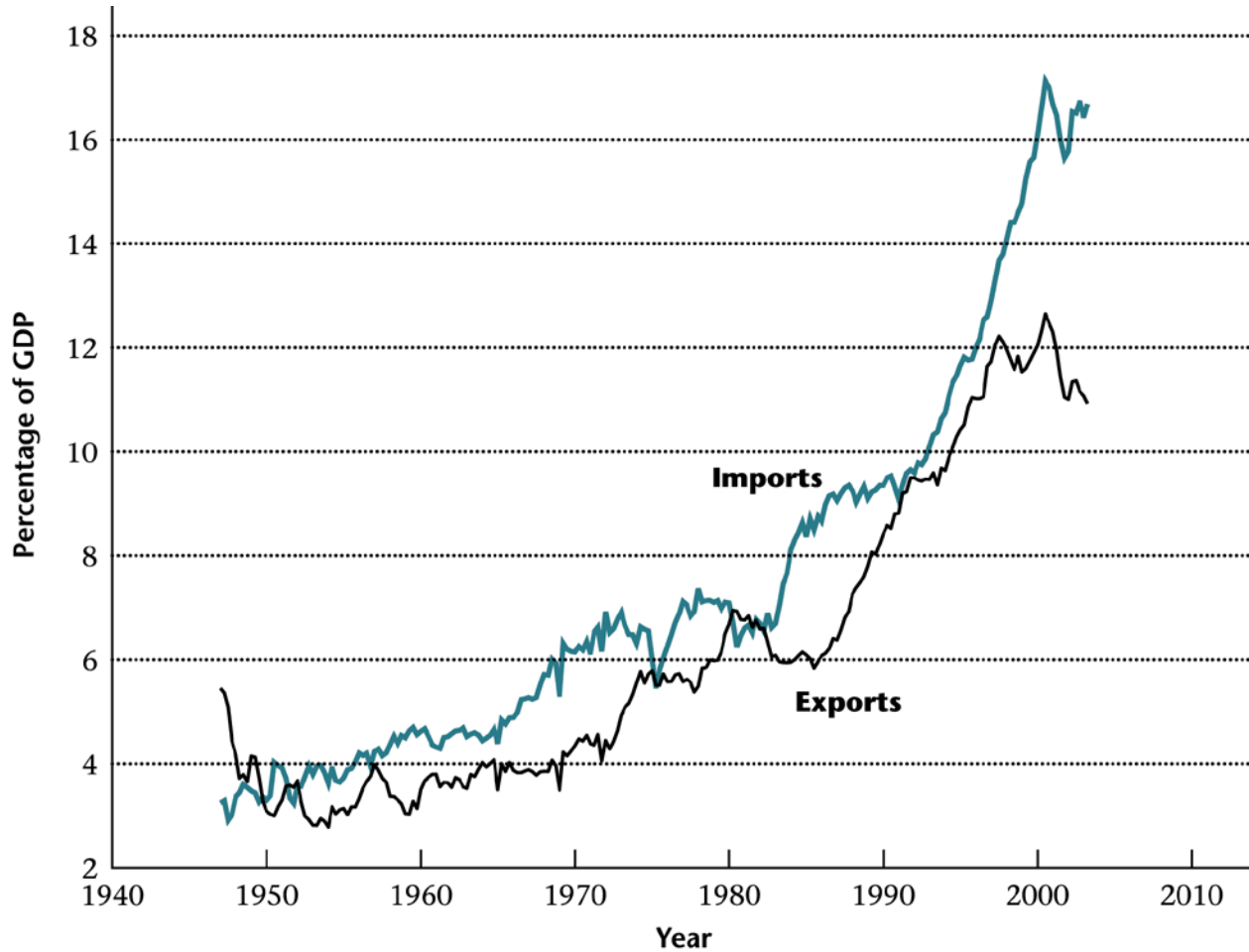
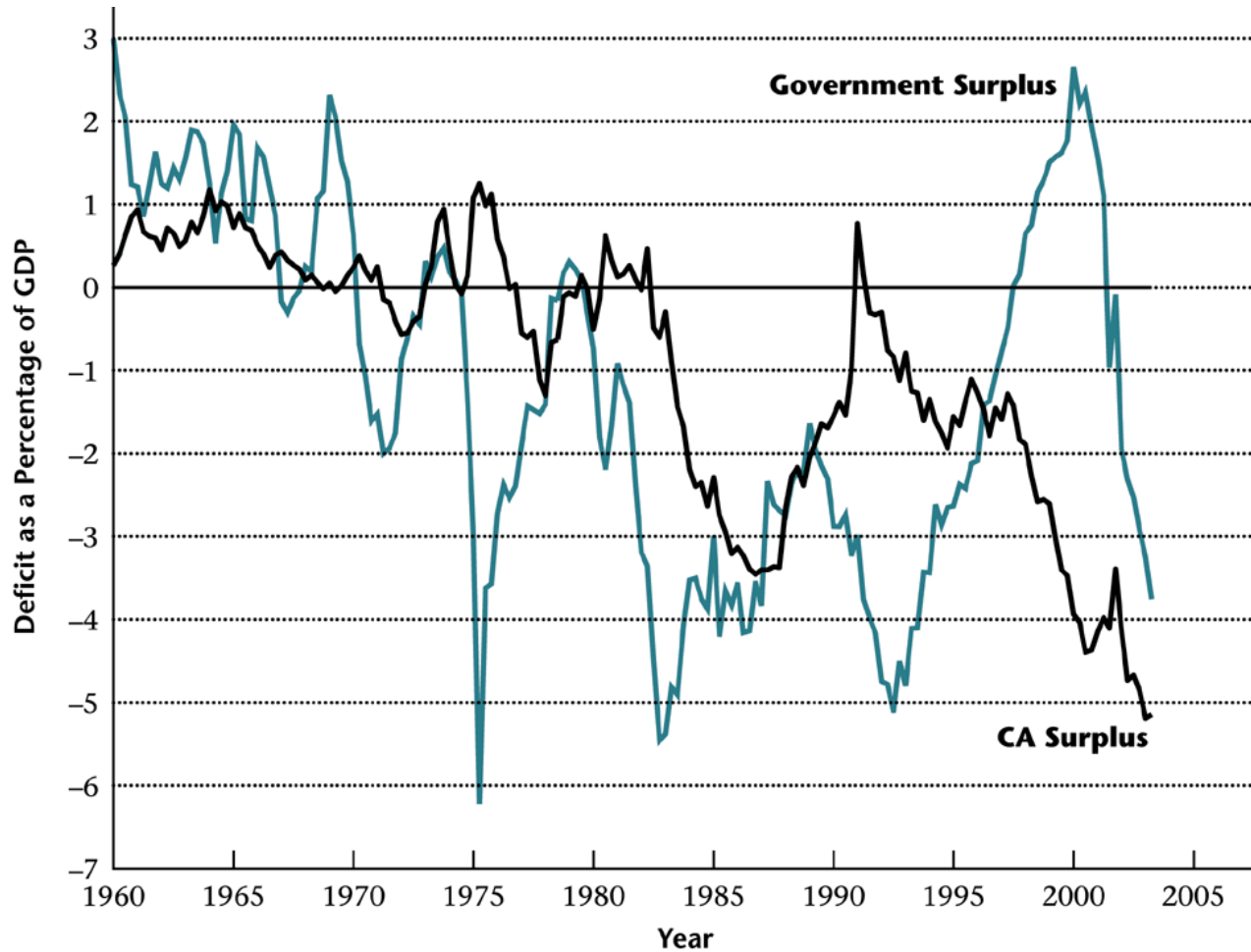


Figure 12 The Current Account Surplus and the Government Surplus, 1960–2003

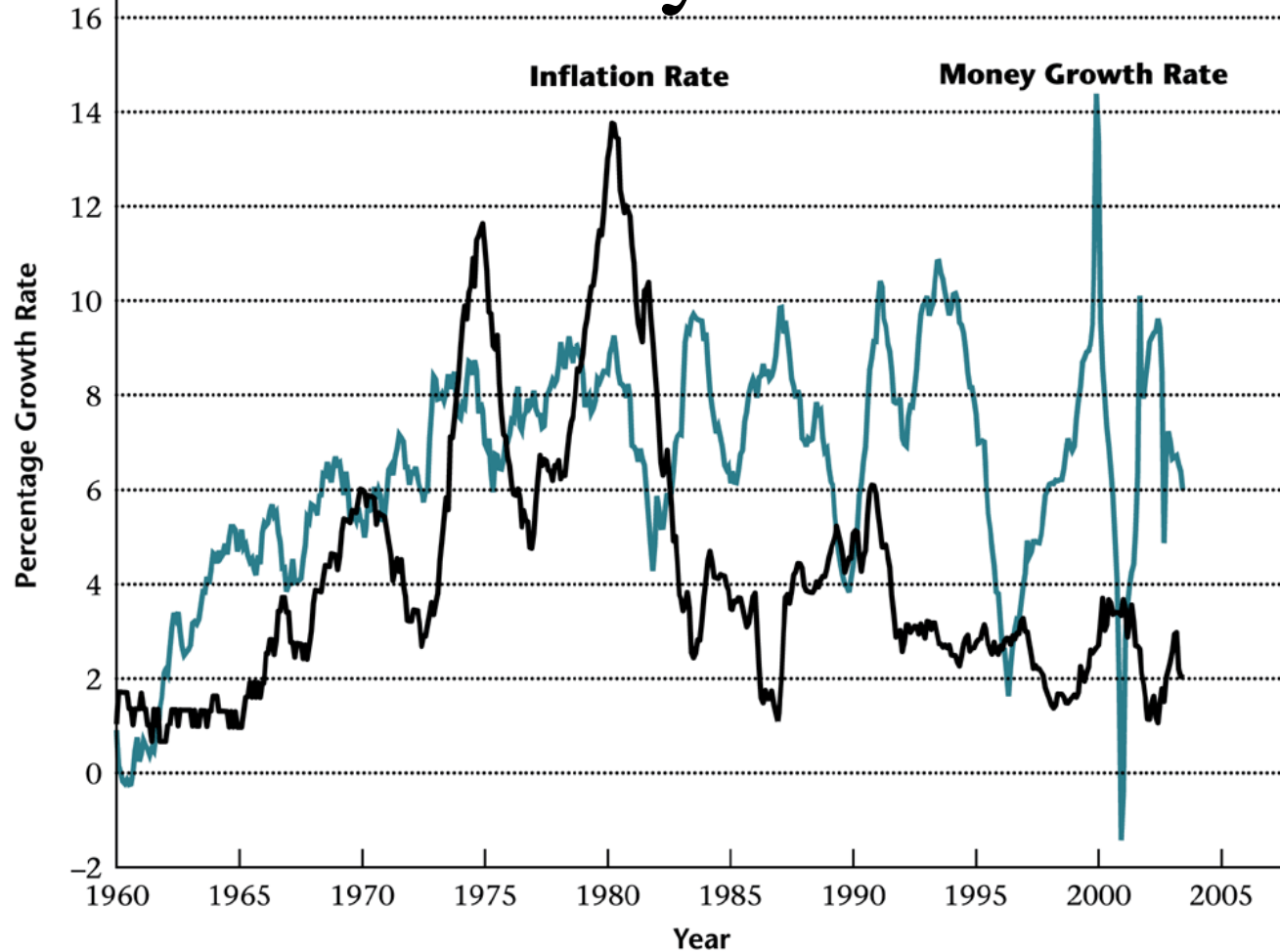


- Inflation

- Money supply growth and inflation co-move from 1960 until 1980s

- The relationship looses after that

Figure 1.13 The Inflation Rate and the Money Growth Rate



- Unemployment
 - Unemployment and Aggregate Economic Activity (Phillips Curve)
 - The Structure of the Population: Baby boom and baby bust
 - Government Intervention: more generous unemployment compensation will induce people search longer
 - Sectoral Shifts: Manufacturing to Service

Figure 14 The Unemployment Rate in the United States, 1948–2003

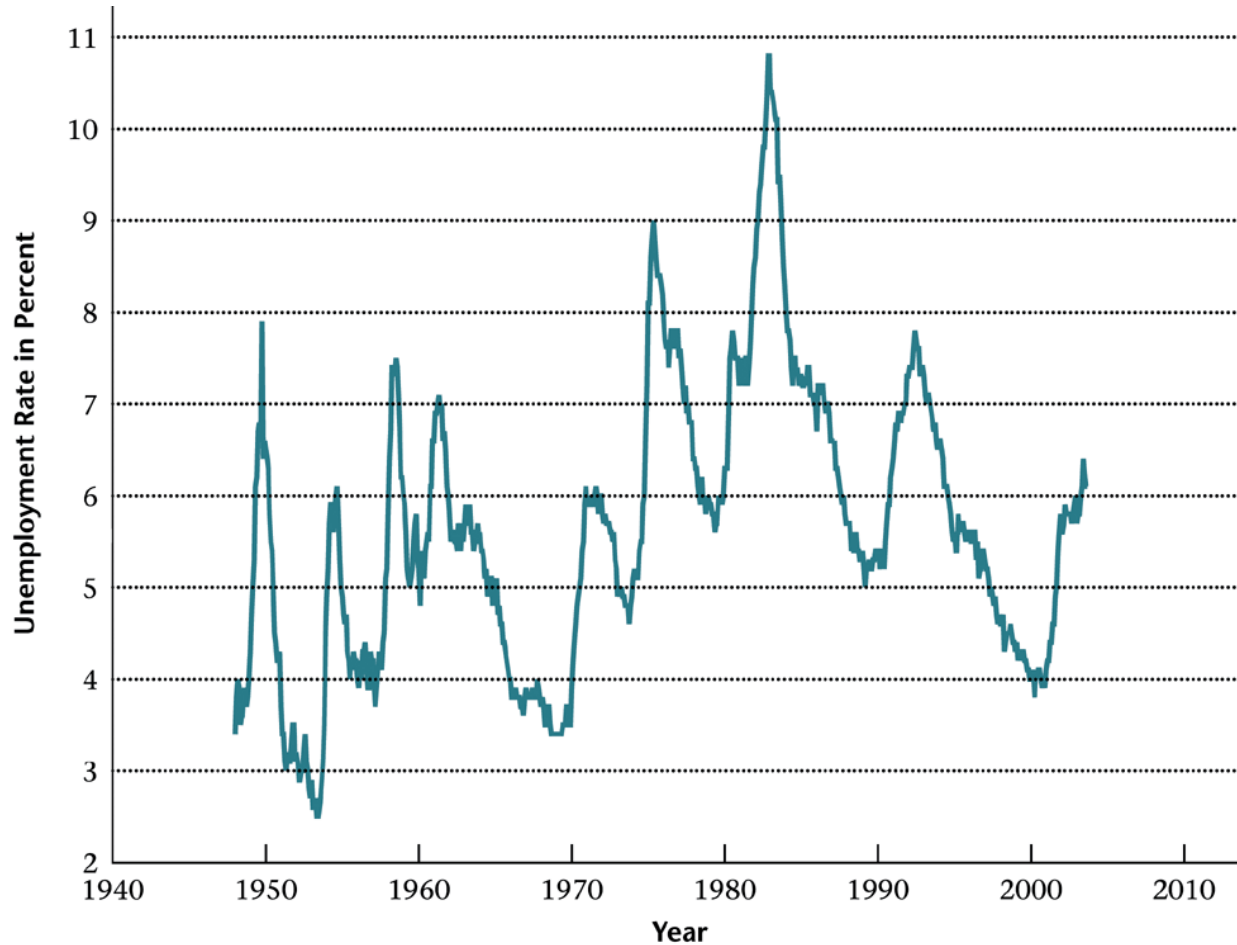
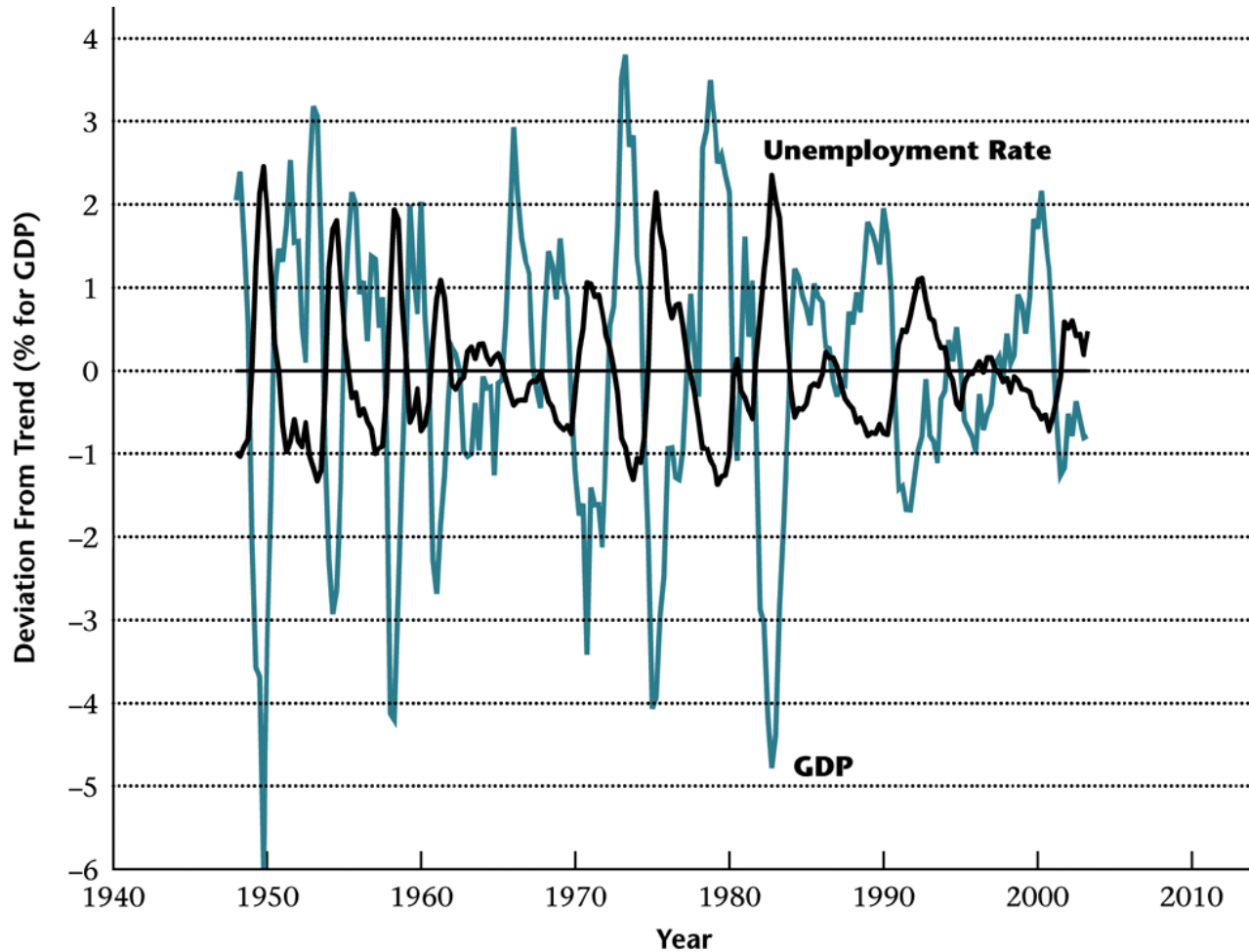


Figure 15 Deviations from Trend in the Unemployment Rate (black line) and Percentage Deviations from Trend in Real GDP (colored line)



Reference and source:

1. Multivariate Time Series Analysis: With R and Financial Applications by Ruey S. Tsay
2. Time Series Analysis by James Douglas Hamilton
3. The Analysis of Time Series: An Introduction with R (Chapman & Hall/CRC Texts in Statistical Science)
4. Machine Learning for Time Series Forecasting with Python by Francesca Lazzeri
5. Time Series Analysis for the Social Sciences (Analytical Methods for Social Research) Part of: Analytical Methods for Social Research (14 Books)
6. Introduction to Probability, Statistics, and Random Processes by Hossein Pishro-Nik
7. Introduction to Time Series and Forecasting (Springer Texts in Statistics) Part of: Springer Texts in Statistics