

Introduction to Public Finance

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Lecture Overview

Size of government relative to the economy

- Receipts and expenditure trends in the U.S. and internationally

General course overview

- ① Role of government in the economy
- ② Budgeting
- ③ Cost analysis and capital budgeting
- ④ Government revenue
- ⑤ Macroeconomic Perspective of Government Finances

Data sources

- Use of official (e.g., government) and other up-to-date data sources

Time value of money

Gross Domestic Product (GDP)

Definition of GDP by the Bureau of Economic Analysis (BEA)

- *“The value of the goods and services produced in the United States is the gross domestic product.”*

Measurement of economic growth by changes in the GDP

- Important aspect of recession dating besides employment levels
- *“We view real GDP as the single best measure of aggregate economic activity. In determining whether a recession has occurred and in identifying the approximate dates of the peak and the trough, we therefore place considerable weight on the estimates of real GDP issued by the Bureau of Economic Analysis (BEA) of the U.S. Department of Commerce.”* [Business Cycle Dating Committee Announcement January 7, 2008](#)

2024 Federal Government in a Nutshell

Outlays ([Federal Budget 2024](#))

- Discretionary outlays (e.g., defense)
- Non-discretionary outlays (e.g., Social Security, Medicare, Medicaid)

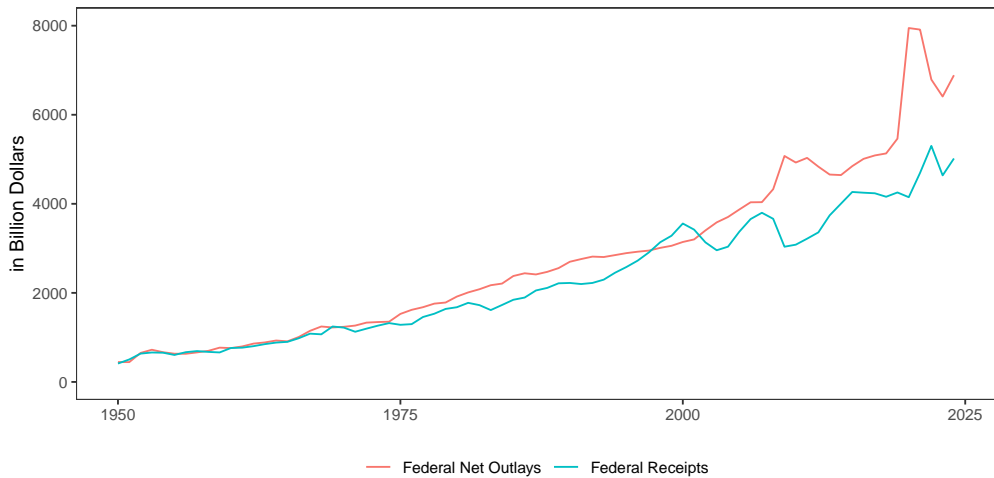
Government revenue (\$4.9 trillion)

- Individual income taxes (\$2.4 trillion)
- Payroll taxes such as Social Security (\$1.7 trillion)
- Corporate income taxes (\$530 billion)
- Other revenues such as excise taxes, estate and gift taxes, customs duties

Government expenditures/outlays (\$6.8 trillion)

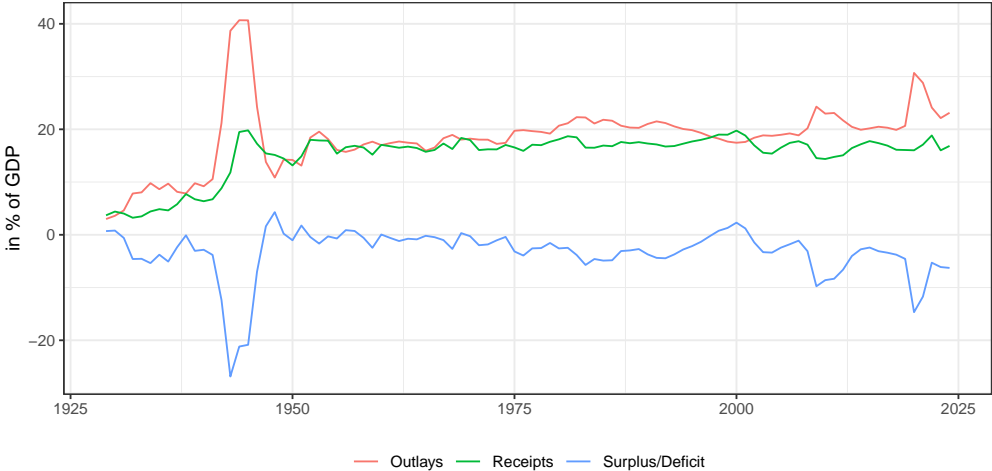
- Mandatory spending (\$4.1 trillion)
- Discretionary spending (\$1.8 trillion)
- Net interest (\$881 billion)

Real Federal Net Outlays and Receipts



Source: FRED Series ID [FYFR](#) and [FYONET](#)

Historical Budget in Percent of GDP



Source: FRED Series IDs [FYFRGDA188S](#), [FYONGDA188S](#), and [FYFSGDA188S](#)

Major Foreign Holders of Treasury Securities

Top 10 Countries	Jan-23	GDP	Ratio
Japan	1,104	4,231	26.1%
China	859	17,963	4.8%
UK	668	3,071	21.8%
Belgium	331	579	57.2%
Luxembourg	318	82	387.8%
Switzerland	291	808	36.0%
Cayman Islands	285		
Canada	254	2,140	11.9%
Ireland	253	529	47.8%
Taiwan	235		

Notes: In Billion USD from [Major Foreign Holders of Treasury Securities](#)

Number of Local Governments in the U.S.

2017 Census of Governments

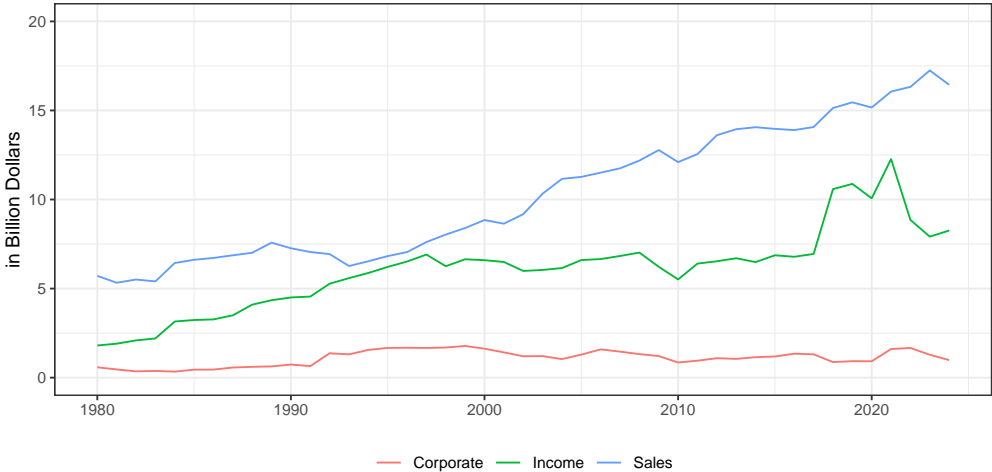
- 50 State governments
- 19,495 Municipal governments
- 16,253 Town or township governments
- 3,031 County governments
- 12,754 Independent school districts
- 38,542 Special district governments

Notes:

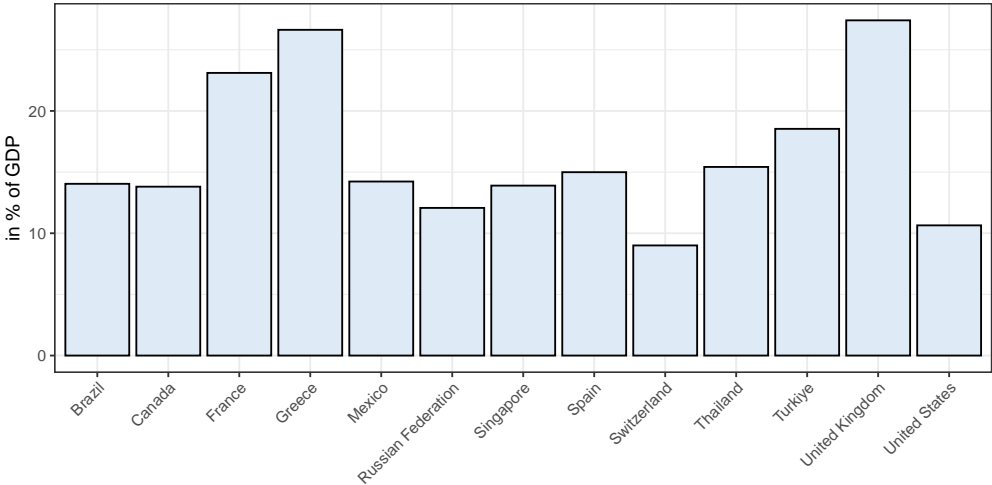
- Source: [U.S. Census Bureau 2017 Census of Governments – Organization](#)
- Relatively stable between 2012 and 2017

Government revenue and expenditures at the state and local level

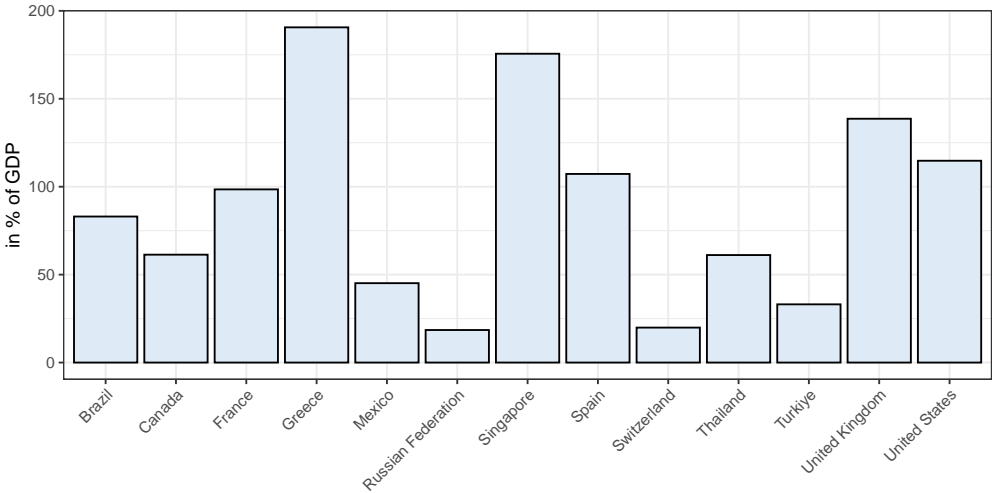
Real State Government Tax Collections: Indiana



Tax Revenue (2023)



Central Government Debt (2023)



Role of Government in the Economy

Real versus nominal prices

- Time value of money (e.g., inflation)

Market failures

- Public goods, externalities, imperfect competition, etc.
- Economic stabilization
- Redistribution

Recurrent Budgets

Budgets on an annual basis

- Matching current receipts and expenditures (services)

Overview of government budgeting

- Budget cycle, budget process, and budget preparation

Federal budget process

- Institutions, audits, and evaluation
- Appropriation bills (required for discretionary spending)
- Mandatory spending (no appropriation bill required)

Budget methods and format

- Budget classification and budget examples
- Cost analysis

Capital Budgeting

Purchasing of capital items

- Assets with a useful life of more than one year
- Non-recurring expenditure
- Examples: Infrastructure such as bridges or airports
- Usually very large expenditure

Cost-benefit analysis

- Net present value analysis

Benefits and expenses over multiple years

Government Revenue I

Various perspectives:

- Economic and political

Taxation

- Efficiency
- Equity
- Adequacy, elasticity, and stability

Economics of taxation

- Per-unit tax versus lump-sum tax

Evaluation of who is burdened by the taxes (e.g., based on income group)

Government Revenue II

Income taxes

- Lump-sum tax (from an economic perspective)
- Largest contributor to the federal budget

Taxes on goods and services

- Sales taxes (as a percentage of price)
- Fuel taxes (per unit tax)
- Influence on consumption of taxed goods

Property taxes

- Source for local funding

Other revenue sources

- User fees and lotteries

Debt Management and Forecasting

Federal level:

- Difference between deficit/surplus (i.e., difference between current fiscal year outlays and revenues) and debt (accumulated over years)

State and local level:

- Revenue sources: (1) Taxes, (2) federal aid, and (3) borrowing

Mechanics of bond values

- Issuer of a bond pays the holder interest and repays the principal at a specific date in the future (maturity date).
- Type of bonds
- Value of bonds

Deficit and debt management

Congressional Budget Office (CBO)

Publication of long-term budget outlooks

- Most current outlook: [CBO Long Term Budget Analysis](#)
- Federal revenues and expenditures given current policies and macroeconomic projections

2002 CBO Projections (January 2002) “The Budget and Economic Outlook: Fiscal Years 2003-2012”

- Projected debt held by the public as a percentage of GDP in 2012: 7.4% (Q1 2023: 93%)

Significant discrepancy between projection and reality:

- Tax cuts, homeland security, 2001 economic downturn, 2008 great recession, stimulus spending (all in the 2000's), COVID-19, etc.

Government Data and International Organizations

Use of objective and unbiased data sources:

- Office of Management and Budget (OMB) of The White House
- Federal Reserve Economic Data (FRED) of the St. Louis Fed
- U.S. Census Bureau
- IMF and World Bank

European Union and OECD

Data Source:

- EUROSTAT and OECD

General government deficit/surplus

- General government deficit/surplus

General government gross debt

- European Union
- General government gross debt

Tax revenue

- OECD Tax Revenue

Real vs. nominal prices

- Consumer Price Index (CPI)
- Personal Consumption Expenditure (PCE) Index
- GDP Deflator
- Producer Price Index (PPI)

Growth rates

Introductory Example

Time period 1

- Income = \$100
- Price of apples = \$5 and 4 apples are purchased
- Price of milk = \$10 and 8 gallons are purchased

Time period 2

- Income = \$120
- Price of apples = \$6 and 4 apples are purchased
- Price of milk = \$12 and 8 gallons are purchased

What about an income of \$110?

Index Numbers and Indices

Index number

- Single value assigned to several individual numbers in order to quantify trends

Index

- Series of index numbers used for tracking over time
- For economics: Important concept to differentiate nominal and real dollar values

Examples

- Consumer Price Index (CPI)
- Dow Jones or S&P 500

Consumer Price Index

Definition by the Bureau of Labor Statistics (BLS):

“The Consumer Price Index (CPI) is a measure of the average change over time in the prices paid by urban consumers for a market basket of consumer goods and services.”

Approximate weights in the market basket (about 80,000 items)

- Food and beverages (15%), housing (43%), apparel (4%), transportation (17%), medical care (6%), recreation (6%), education and communication (6%), and other goods and services (3%)

Tracking and reporting the price level

- Urban consumers represent about 87% of the U.S. population

Only real values matter!

Construction of the CPI

Constructing the CPI using a market basket (MB)

$$CPI_t = \frac{MB_t}{MB_b} \cdot 100$$

where MB_t and MB_b represent the market basket's cost in the year of interest t and the base year b , respectively. Example:

- $MB_t = \$71$ and $MB_b = \$68$ then $CPI = 71/68 \cdot 100 = 104.41$

Use of the CPI:

- Economic indicator and policy target
- Deflator of other economic series (i.e., translation from nominal to real prices)
- Means of adjusting dollar values (e.g., pensions)

CPI and Inflation

Problems with the CPI

- Substitution bias: consumers shift their purchases away from goods whose relative prices rise towards lower priced goods
- New technologies: when new, higher priced goods replace older goods
- Changes in Quality: failing to take into account of quality improvements that raise prices
- Growth in Discounting: with high prices, people switch to low-cost discount stores

The monthly inflation rate reported in the news is the percentage change in the price level over a 12 months period. The inflation rate can be calculated as follows:

$$\pi_t = \frac{CPI_t - CPI_{t-1}}{CPI_{t-1}} \cdot 100$$

Headline Inflation vs. Core Inflation

Food and energy prices are very volatile

- Bad weather and subsequent decline in crop yields
- Fluctuations in oil supply triggered by OPEC

Economists usually exclude those items which results in **core inflation**.

- The July 2023 figure of 3.3% represents **headline inflation** (i.e., including food and energy prices): CPI was 294.628 and 304.348 in July of 2022 and 2023, respectively
- Increase represents 3.3%

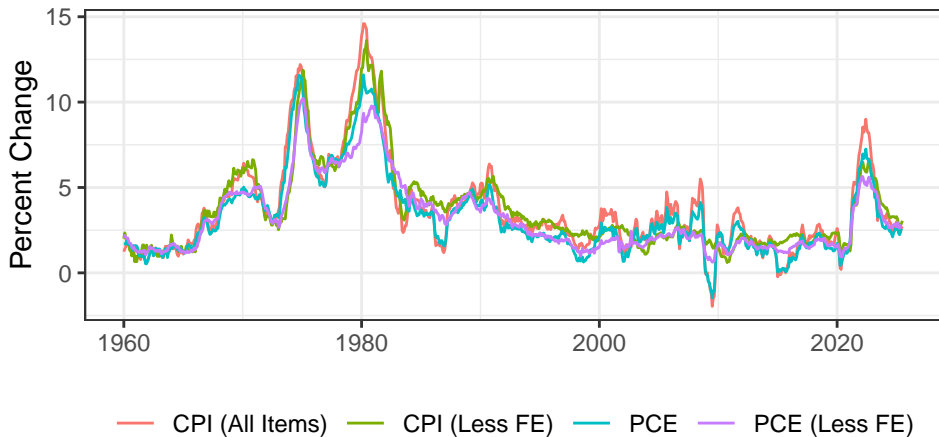
CPI source: [Data](#)

Personal Consumption Expenditure Index

Footnote of the Monetary Policy Report to the Congress (17 February 2000)

“The chain-type price index for PCE draws extensively on data from the consumer price index but, while not entirely free of measurement problems, has several advantages relative to the CPI. The PCE chain-type index is constructed from a formula that reflects the changing composition of spending and thereby avoids [...] fixed-weight nature of the CPI. In addition, the weights are based on a more comprehensive measure of expenditures. Finally, historical data used in the PCE price index can be revised to account for newly available information and for improvements in measurement techniques, including those that affect source data from the CPI; the result is a more consistent series over time.”

Monthly CPI and PCE



Constant Dollar Calculations: Formula

Constant dollar calculation

$$CD_b = \frac{ND_t \cdot CPI_b}{CPI_t}$$

where

- CD_b : Constant dollar or real value
- ND_t : Nominal value in period t
- CPI_b : Consumer Price Index in the base period
- CPI_t : Consumer Price Index in period t

Constant Dollar Calculation: Example

Gasoline price in 1979 expressed in 2022 USD:

- May 1979: $ND_{1979} = 0.84$
- $CPI_{05/1979} = 71.4$ ($CPI = 100$ in 1982-1984)
- $CPI_{04/2022} = 288.663$
- $b = 04/2022$
- $t = 05/1979$

$$CD_{04/2022} = \frac{ND_{05/1979} \cdot CPI_{04/2022}}{CPI_{05/1979}} \Rightarrow \frac{0.84 \cdot 288.663}{71.4} = 3.40$$

BLS [Calculator](#)

Decomposition of Growth Rates

Two components with respect to changes in dollar amounts:

- Real component: Change in the quantity of goods and services
- Inflation (price) component: Change in the prices of goods and services

Federal government national defense consumption expenditures and gross investment in nominal terms (FRED ID: [FDEFX](#)):

- 2010: \$827.971 billion
- 2019: \$847.830 billion
- 2020: \$882.443 billion

GDP Implicit Price Deflator (FRED ID: [GDPDEF](#)):

- 2010: 95.023
- 2019: 112.315
- 2020: 113.769

Price Increase

General percentage change formula:

$$\Delta\% = \frac{x_{t+1} - x_t}{x_t} \cdot 100 = \left(\frac{x_{t+1}}{x_t} - 1 \right) \cdot 100$$

Let x_t and x_{t+1} be the deflator in 2019 and 2020, respectively. Thus, we have the following:

$$\Delta\% = \frac{x_{2020} - x_{2019}}{x_{2019}} \cdot 100 \Rightarrow \frac{113.769 - 112.315}{112.315} = 1.29\%$$

Nominal Spending Increase

Let x_t and x_{t+1} be the defense consumption expenditures and investments in 2010 and 2020, respectively. Thus, we have the following:

$$\Delta\% = \frac{x_{2020} - x_{2019}}{x_{2019}} \cdot 100 \Rightarrow \frac{882.443 - 847.830}{847.830} = 4.08\%$$

How much of 4.08% was real change and not inflation?

- Conversion of outlays into constant dollars

Real Spending Increase

Procedure (\$ values in billion):

- 2020 outlays in 2020 dollars: \$882.443
- 2019 outlays in 2020 dollars: \$858.806

$$\frac{847.830 \cdot 113.769}{112.315} = 858.806$$

Real change of expenditures between 2019 and 2020:

$$\Delta\% = \frac{x_{2020} - x_{2019}}{x_{2019}} \cdot 100 \Rightarrow \frac{882.443 - 858.806}{858.806} = 2.75\%$$

For nominal growth (g), inflation (h), and real growth (m):

$$(1 + g) = (1 + h) \cdot (1 + m) \Rightarrow 1.0408 = 1.0275 \cdot 1.0129$$

Compound Growth Rates

National defense expenditures and investment between 2010 and 2020

- Nominal growth over entire period: 6.58%
- Real growth over entire period: -9.92%

Compound growth rate k (annual terms):

$$k = \left(\frac{x_1}{x_0} \right)^{1/N} - 1$$

where x_0 and x_1 represent the start and end value, respectively. N represents the number of periods.

$$\left[\frac{882.443}{827.971}^{1/10} - 1 \right] \cdot 100 = 0.64\%$$