Graduate Public Finance

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Princeton
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Week 1

Outline

1. Overview
   - Introductions, logistics, schedule, goals of course
   - What is public finance/ why study it?
   - Trends and open areas of research
   - Virtual paper assignment
2. Policy and background facts
   - Federal Government: Taxes and Spending
   - State and Local Government: Taxes and Spending
   - (Very brief) Taxes and Spending outside the U.S.
3. Government Intervention in the Economy
   - Equity consequences of taxation
   - Incidence of Mandated Benefits
   - Efficiency consequences of taxation
4. Application: Incidence Example (Cabral, Geruso, Mahoney, AER 2018)

Introductions: who am I/ who are you?

1. **My background**
   - Ph.D. from UC Berkeley, BA from Dartmouth
   - Staff Economist at Council of Economic Advisers
   - Previously an Assistant Professor at Chicago Booth
   - Co-chair NBER business tax group
2. **Research fiscal policy topics**
   - Incidence and efficiency costs of corporate taxation
   - Economic impacts of taxing high-income earners
   - Effect of state tax system on U.S. economy
   - The structure of state corporate taxation
   - Business taxation and ownership in the U.S.
   - Who profits from patents? Rent sharing at innovative firms
   - Business Income and U.S. income inequality

Logistics and Goals

Logistics:

1. Class schedule
2. Referee report
3. Written response papers
4. Virtual paper

Goals:

1. Provide context and guidance on open research questions
2. Help you to think actively, critically, and constructively about research
3. Present benchmark models and new research
4. Enhance your applied modeling and empirical skills

Course Outline

1. **Overview: Equity, Efficiency, and Fiscal Policy**
2. **Spatial Public Finance and Place-Based Policies**
   1. Rosen-Roback spatial model
   2. Place-based policies and local economic development
   3. Sorting, Fiscal federalism
3. **Capital Taxation**
   1. Overview of capital taxes: property, wealth, and corporate taxation
   2. Capital taxes in an open economy
   3. The Harberger model and evidence on corporate tax incidence
4. **Taxing firms and top earners**
   1. Firms, taxes, and financial policy
   2. Investment
   3. Entrepreneurship, Innovation, and Top earners

What is Public Finance?

Answers two types of questions:

1. How do government policies affect the economy?
2. How should policies be designed to maximize welfare?

Motivation:

1. Practical Relevance
2. Academic Interest
3. Methods

Motivation 1: Practical Relevance

- Interest in improving economic welfare $\rightarrow$ interest in public economics
- Almost every economic intervention through government policy (i.e., involves public economics) via two channels
  1. Price intervention: taxes, welfare, social insurance, public goods
  2. Regulation: min wages, FDA , regulation, zoning, labor laws, environment, min education laws
- Macro-economic stabilization through central bank (interest rate, inflation control), fiscal stimulus, bailout policies
- Government directly employees one sixth of the US workforce

Motivation 1: Practical Relevance

- Stakes are very big because of broad scope of policies
  - E.g., tax reforms that immediately affect hundreds of millions
- Contentious debate on the appropriate role of government in society
  1. How big should government be? What should it provide?
  2. What should we tax? At what rate? With what structure?
  3. Example. Replacing Medicare with decentralized private insurance will:
     - improve health outcomes and reduce costs OR
     - worsen health outcomes and raise costs
- Only one of these views can be correct.
- Injecting science into these debates has great practical value

Motivation 2: Academic Interest

- Public economics is typically the end point for many other subfields
- Macro, development, labor, urban, and corporate finance questions often ultimately motivated by a public economics question
- Understanding public finance can help ensure that you work on relevant topics

Motivation 3: Methods

- Public economics is at the frontier of a methodological transformation in applied microeconomics
- Data-driven approach to answering important policy questions
  1. Combines a broad set of skills: applied theory, applied econometrics, simulation methods
  2. Useful skill set for many applied fields in economics
- Topics in the course reflect a broad set of methodological themes

Theme 1: Connecting Theory to Data

- Modern public economics tightly integrates theory with empirical evidence to derive quantitative predictions about policy
  1. What is the optimal income tax rate?
  2. Who benefits from corporate tax cuts?
- Traditional approach: theoretical models and numerical simulations
  1. Theory often makes weak predictions: optimal tax rate between 0 and 100%
  2. Numerical simulations rely on strong assumptions
- Recent work derives formulas that can be implemented using well-identified empirical estimates
- Ideally, you can derive the empirical regression specification from economic primitives to (1) understand the error term, (2) focus on key forces, (3) quantify responses/ understand magnitudes

Theme 1: Connecting Theory to Data

Examples

- Skill biased technical change Katz-Murphy QJE 1992 (see supplemental sbtc notes, which derive the main regression in 1 page)
- Gravity expressions in trade (see Treb Allen's lecture 1 (equations 1 to 13), which derives the gravity regression specification)
- Spatial PF
  1. Rosen-roback
  2. Who benefits from corporate tax cuts?
  3. State taxes and spatial misallocation
- Who profits from patents? (and most other Pat Kline papers)
- Many many others

Theme 2: Quasi-Experimental Empirical Methods

Examples

- Research in public economics exploits a variety of quasi-experimental research designs to identify parameters of interest
    1. Event studies, regression discontinuity, synthetic control
- Good way to learn practical lessons in applied econometrics
- Emphasis on non-parametric graphical techniques rather than parametric regression models

Theme 3: Big Data (but also big questions!)

Examples

- Compelling implementation of quasi-experimental methods requires a lot of data
- Recent availability of very large datasets has transformed research in applied microeconomics
  1. Scanner data on consumer purchases
  2. Header data on credit reports
  3. tax and social security records
  4. school district info
  5. credit card data

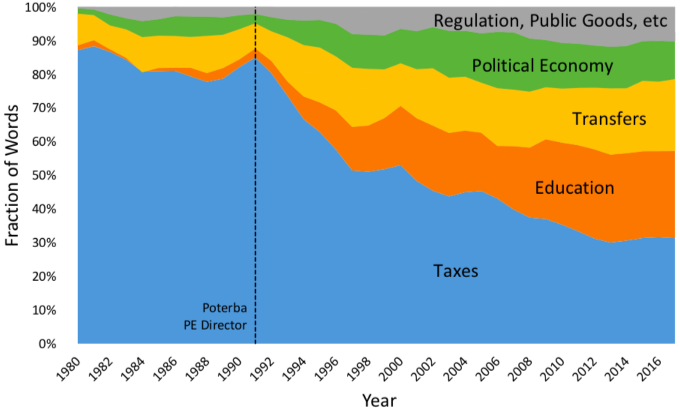
Theme 4: Revival of classic PF questions?

- 1990s credibility revolution led to a lot of focus on establishing well-identified facts on questions of individual behavior (e.g., effect of UI on job spells)
- Renewed interest in capital taxation, state and local, urban PF, fiscal federalism, public goods, and many other classic PF topics

Theme 4: Revival of classic PF questions?

Overview			
	1990	2000	2010
Total # of NBER Working Papers	398	665	1025
Total # of Working Papers in Public Economics	55	153	183
Share of Working Papers in Public Economics	13.8%	23.0%	17.9%
Public Economics Working Papers by Methodology			
	1990	2000	2010
Empirical	29.1%	46.4%	52.5%
Theory	38.2%	37.3%	30.1%
Both	29.1%	11.8%	5.5%
Other (survey of the literature, research methodology, etc)	3.6%	4.6%	12.1%
Public Economics Working Papers by Topic			
	1990	2000	2010
Tax	63.6%	28.1%	15.3%
Spending	5.5%	13.7%	20.8%
Tax and Spending	0.0%	7.8%	1.1%
Other (Education, Regulation, etc)*	30.9%	50.3%	62.8%
Public Economics Working Papers on Taxation: Corporate vs. Individual			
	1990	2000	2010
Individual	47.1%	79.2%	88.9%
Corporate	41.2%	13.2%	7.4%
Both	11.8%	7.5%	3.7%

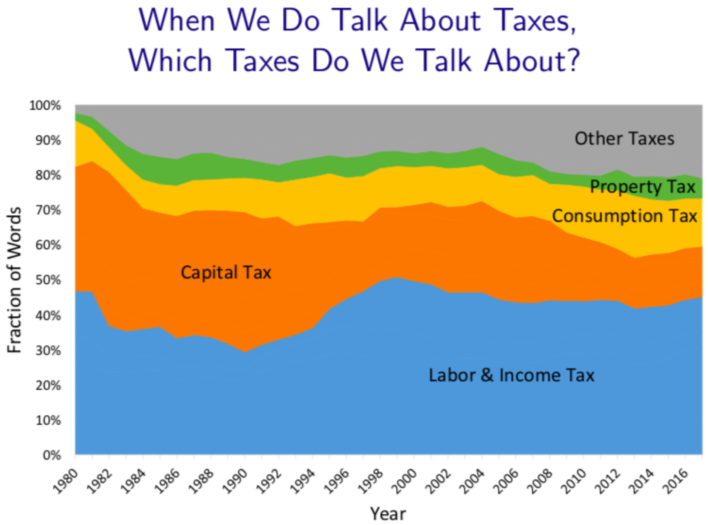
What have people been working on in PF?



Note: The graph shows the frequency of words within different topics as a fraction of all words across topics. See here for a list of words included in each category. The graph shows 3-year moving averages.

Source: Henrik Kleven

What have people been working on in PF?



Note: The graph shows the frequency of different words as a fraction of all words in the tax topic. See here for a list of words included in each category. The graph shows 5-year moving averages.

Some great topics for JMPs

1. Taxation of multinationals/structure of corporate taxation
2. Redistribution in a federal system
3. The size and scope of local government
4. Policy responses to rising inequality/ spatial disparities in opportunity
5. Pensions/ state and local fiscal health
6. PF of declining regions/aging societies
7. Municipal bonds/finance
8. Inherited versus self made wealth
9. How savings respond to taxation
10. Business location subsidies and local economic development
11. Effect of property taxes
12. Taxation and the supply of capital
13. Taxes and economic growth
14. Structure of the safety net
15. Effect of government spending on productivity
16. Tax competition
17. many many more

Hendren's top 12 "open" questions

1. Why and how does childhood exposure to places impact children?
2. Incidence of capital taxation
3. How should we respond to geographic shocks (e.g. china/robots/ etc)
4. Desirability of place-based versus national policy
5. Political economy constraints (e.g., optimal decentralization)
6. Why don't people take up social benefits (and should incent them?)
7. What other markets are missing because of private information and what are the welfare implications (credit? income insurance?)
8. Distortionary costs of racial and gender bias on economic outcomes/ Impact of policies that reduce gender bias/ anti-racism policies
9. Integrating social insurance with optimal tax: how much should we redistribute "in-kind" or through social programs vs through taxes?
10. Competition in insurance markets? What happens when insurers have asymmetric info (and know more than the applicant)?
11. Government versus markets – should the government, e.g., provide schooling directly or fund charter schools?
12. Endogenous preferences and impact on PF/ role of policy

Your virtual paper

Main project for the course, due at end of the term.

- Intro: What is the specific question/specific hypothesis being tested?
- Motivation: Why is the question of interest? Why should we care/why is this important?
- Lit Review/ Contribution: What is the potential contribution of this paper relative to the existing literature? What do we learn about the world that we didn't know before your paper?
- Model: Ideally, your model connects directly to well-defined policy or welfare questions. And you can lay out explicit economic assumptions that justify your econometric assumptions.
- Data: What data would you use to answer/address this question?
- Empirical Methodology/Research design: How would you use the data to answer your question? Be explicit about identification and causality, keeping in mind that the same set of empirical facts can often support many theories. What's the perfect experiment?
- Falsification Tests: What other specifications and tests could either bolster or cast doubt upon the primary tests of your hypotheses?

Your virtual paper: what is a research design (1/2)

- Consider the effect of a treatment (e.g., tax) T on outcome y

$$y_i = \alpha + \beta T_i + \varepsilon_i$$

- Treatment is assigned based on "selection" model

$$T_i = \alpha_T + \beta_T X_i + \eta_i$$

- Treatment may be non-random: $cov(X_i, \varepsilon_i) \neq 0, cov(\eta_i, \varepsilon_i) \neq 0$
- Traditional approach to accounting for confounding factors or selection: control for observables X_i when estimating treatment effect

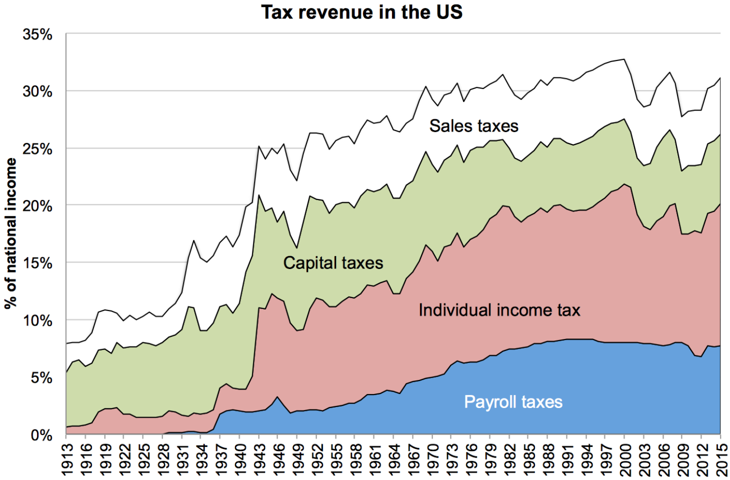
$$y_i = \alpha + \beta T_i + \gamma X_i + \varepsilon_i$$

Your virtual paper: what is a research design (2/2)

- Problem with this approach is that we don't know the source of variation in T_i
- There must be some reason that one person or location got treated and another did not even if they are perfectly matched on observables (e.g., twins)
  - η_i must to correlated with T_i to have variation in $T_i|X_i$
- But that same unobserved factor could also affect outcome: no way to know if $cov(\eta_i, \varepsilon_i) = 0$
- A **research design** is a source of variation in η_i that is credibly unrelated to ε_i
  - E.g., a reform that affects people above age 65 but not below. People at age 64 and 65 likely to have similar outcomes $\Rightarrow cov(\eta_i, \varepsilon_i) = 0$

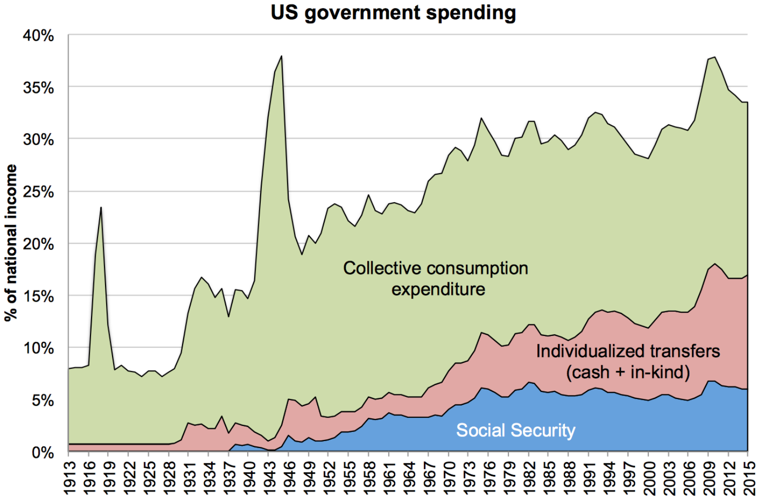
Background facts on fiscal policy

Total U.S. Tax Revenue (i.e., Fed + State + Local)



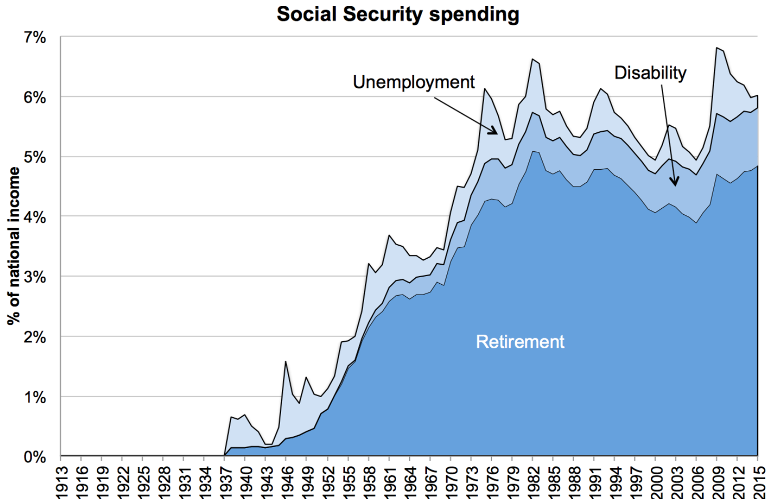
Source: G. Zucman

Total U.S. Government Spending (i.e., Fed + St+ Local)



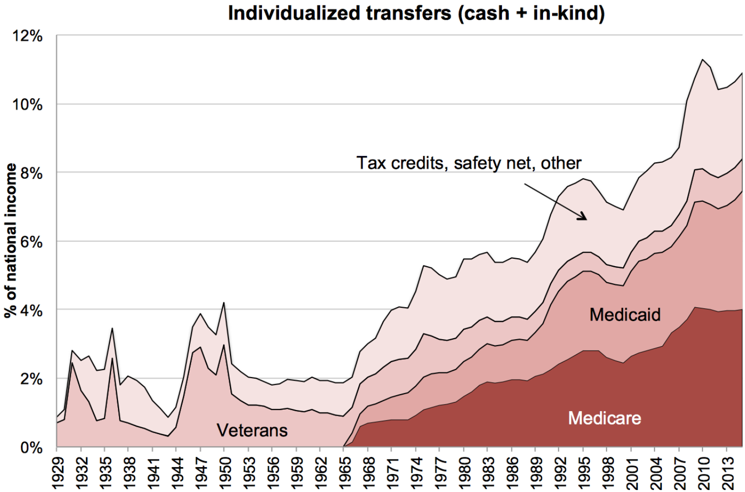
Source: G. Zucman

Social Security Spending



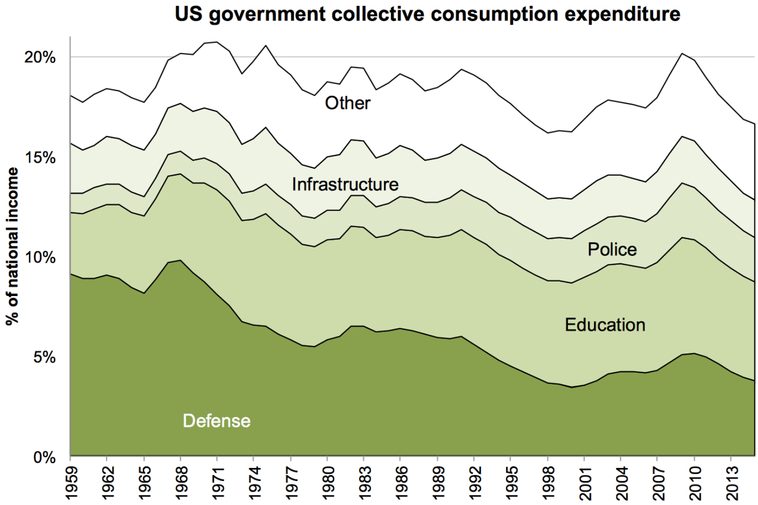
Source: G. Zucman

Individualized transfers (cash + in-kind)



Source: G. Zucman

US government collective consumption expenditure



Source: G. Zucman

Federal Tax System Overview

Federal US Tax System: Overview

1) Individual income tax (on both labor+capital income) [progressive](40% of fed tax revenue)

2) Payroll taxes (on labor income) financing social security programs [about neutral] (40% of revenue)

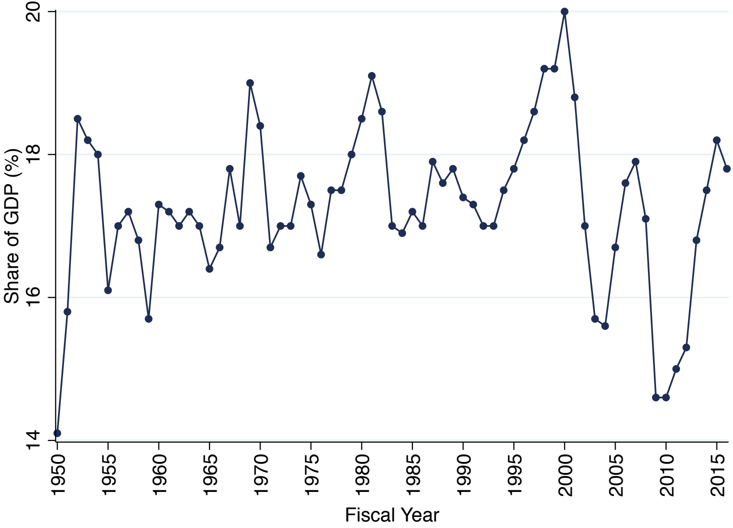
3) Corporate income tax (on capital income) [progressive if incidence on capital income] (15% of revenue)

4) Estate taxes (on capital income) [very progressive] (1% of revenue)

5) Minor excise taxes [regressive] (3% of revenue)

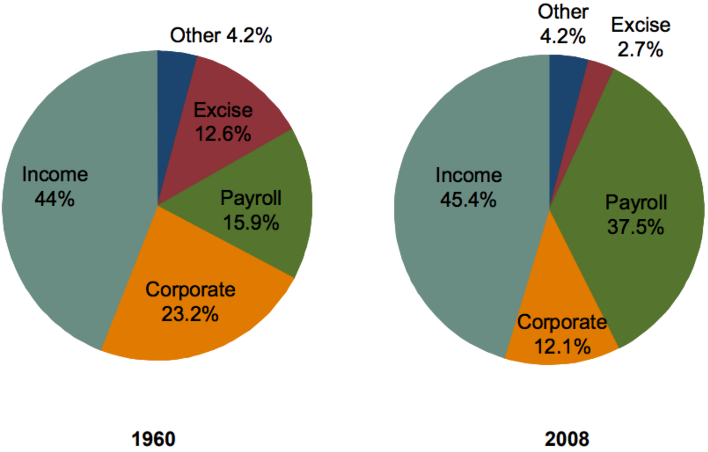
Source: E. Saez

Federal Revenue ≈ 17% of GDP



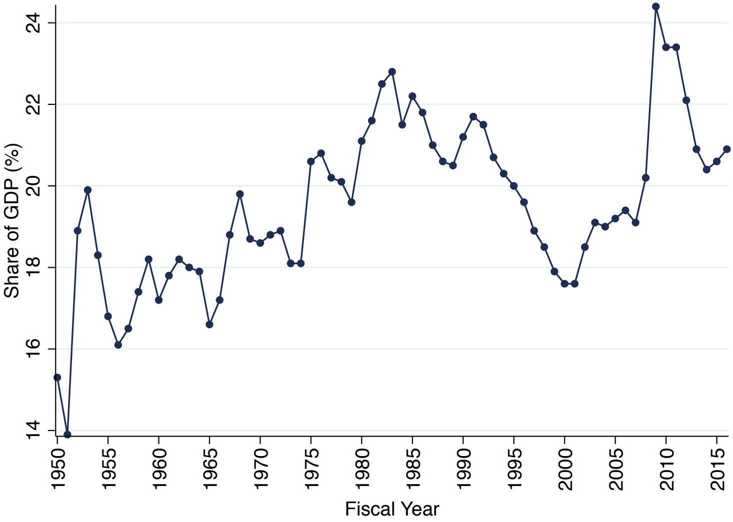
Source: White House Office of Management and Budget

Federal Revenue (% of total revenue)



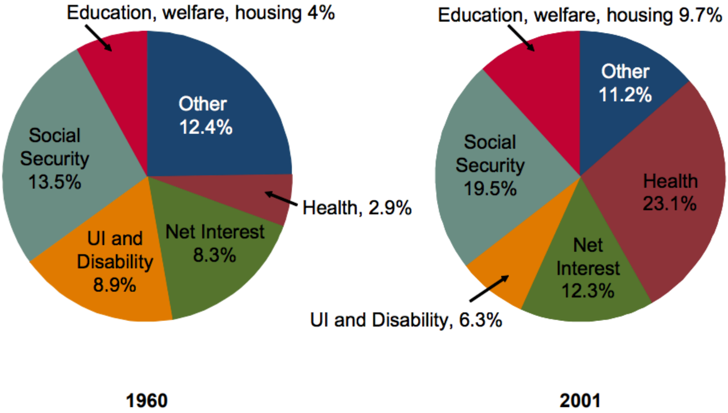
Source: Office of Management and Budget, historical tables, government receipts by source

Total Federal Spending (% of GDP)



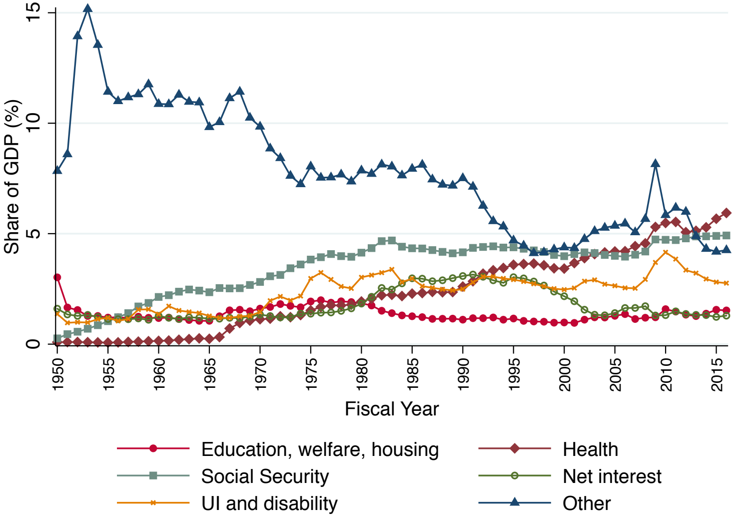
Source: White House Office of Management and Budget

Federal Spending (% of total spending)



Source: Office of Management and Budget, historical tables, government outlays by function

Total Federal Spending by Function (% of GDP)



Source: White House Office of Management and Budget

Federal Spending Categories

1. **Education, welfare, housing**: Education, Training, Employment, and Social Services; Veterans Benefits and Services
2. **Health:** Health; Medicare
3. **Social Security**
4. **Net interest**
5. **Other:**
    - Physical resources: Energy; Natural Resources and Environment; Commerce and Housing Credit; Transportation; Community and Regional Development
    - Other functions: International Affairs; General Science, Space, and Technology; Agriculture; Administration of Justice; General Government; Allowances
    - Undistributed offsetting receipts
6. **UI and disability:** Income Security

State+Local Tax System: Overview

1) Individual+Corporate income taxes [progressive] (1/3 of state+local tax revenue)

2) Sales + Excise taxes (tax on consumption = income - savings) [about neutral] (1/3 of revenue)

3) Real estate property taxes (on capital income) [slightly progressive] (1/3 of revenue)

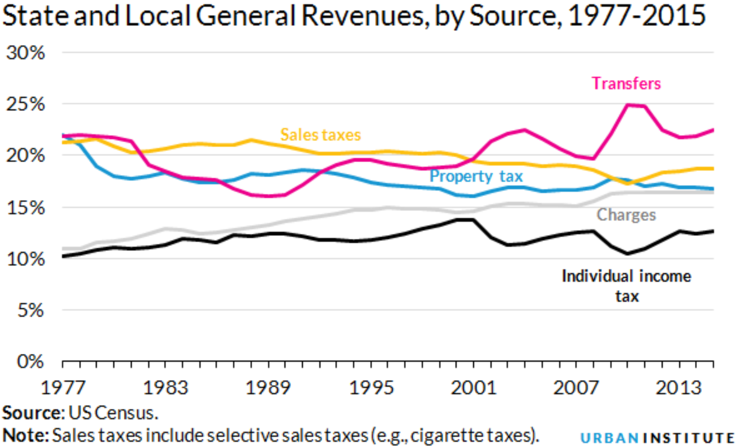
http://www.census.gov/govs/www/qtax.html

Source: E. Saez

State & Local Tax Revenue (% of GDP)

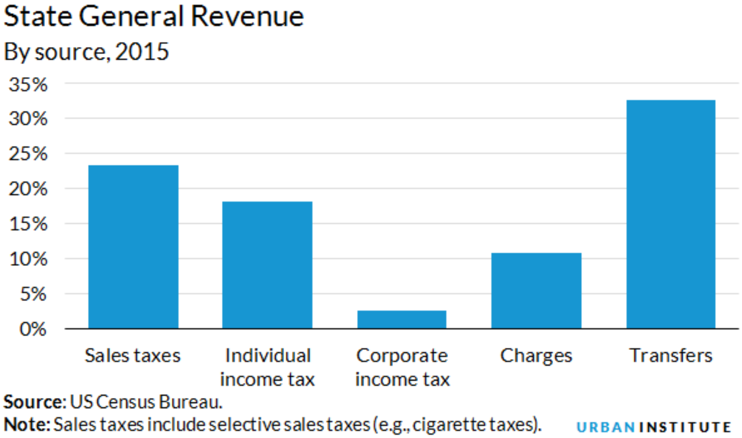
Source: State and Local Government Finance; Bureau of Economic Analysis (BEA)

State & Local Tax Rev (and Fed Transfers) by source



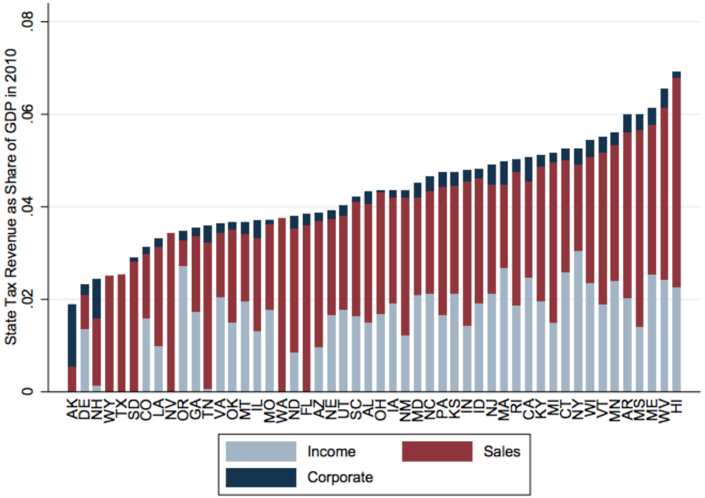
Source: Urban state and local backgrounders
`https://www.urban.org/policy-centers/cross-center-initiatives/state-local-finance-initiative/state-and-local-backgrounders`

State revenue sources

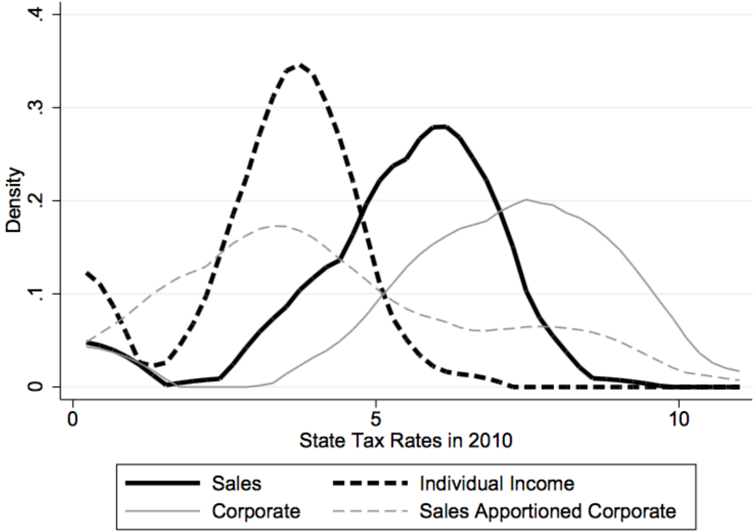


Source: Urban state and local backgrounders
`https://www.urban.org/policy-centers/cross-center-initiatives/state-local-finance-initiative/state-and-local-backgrounders`

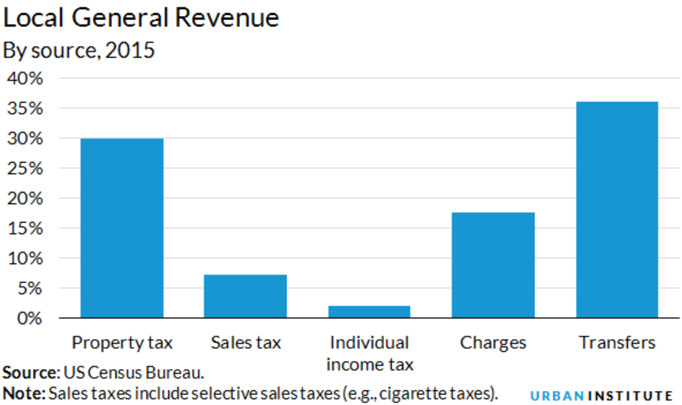
State tax system varies across states



State tax rates (and tax structure) vary across states

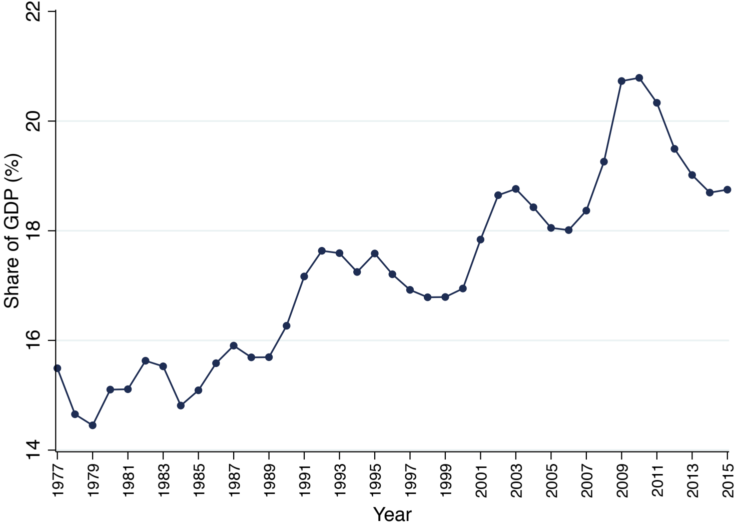


Local revenue sources



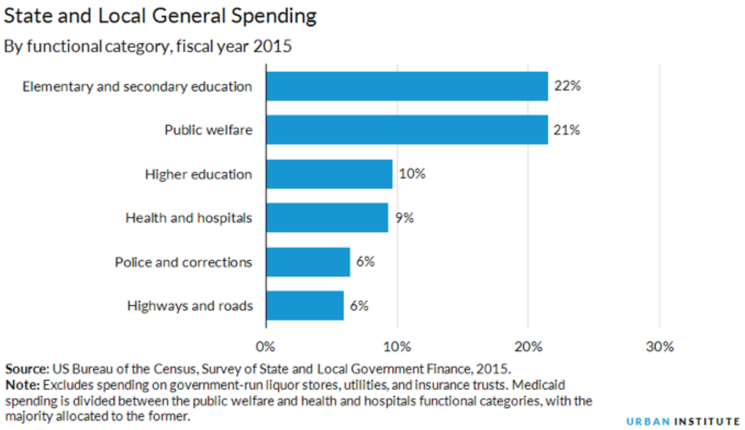
Source: Urban state and local backgrounders
https://www.urban.org/policy-centers/cross-center-initiatives/state-local-finance-initiative/state-and-local-backgrounders

State & Local Direct Spending (% of GDP)



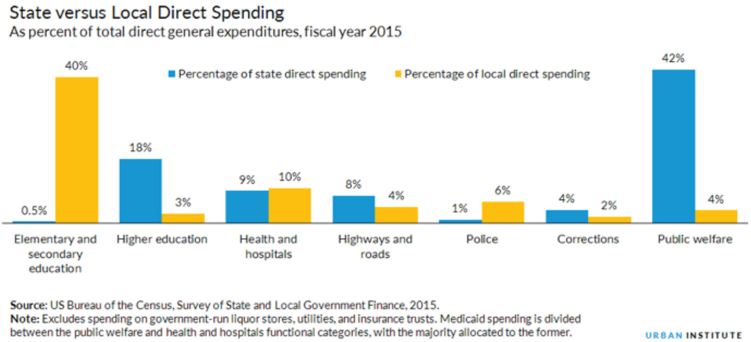
Source: State and Local Government Finance; Bureau of Economic Analysis (BEA). Figure does not include transfers.

State & Local spending by type



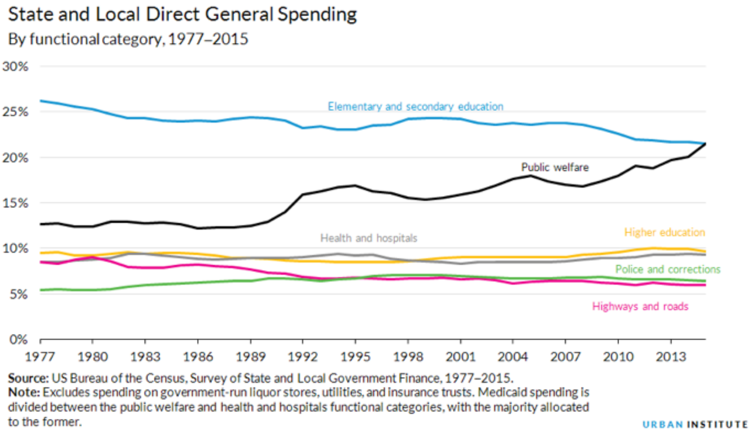
Source: Urban state and local backgrounders
`https://www.urban.org/policy-centers/cross-center-initiatives/state-local-finance-initiative/state-and-local-backgrounders`

State vs Local spending by type



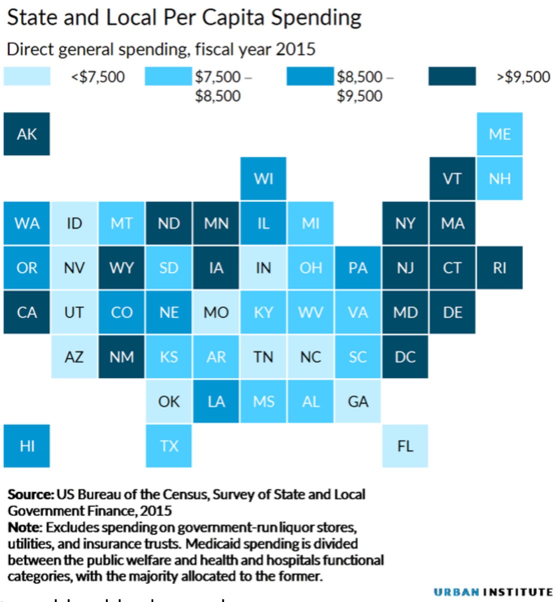
Source: Urban state and local backgrounders
https://www.urban.org/policy-centers/cross-center-initiatives/state-local-finance-initiative/state-and-local-backgrounders

State & Local spending overtime



Source: Urban state and local backgrounders
`https://www.urban.org/policy-centers/cross-center-initiatives/state-local-finance-initiative/state-and-local-backgrounders`

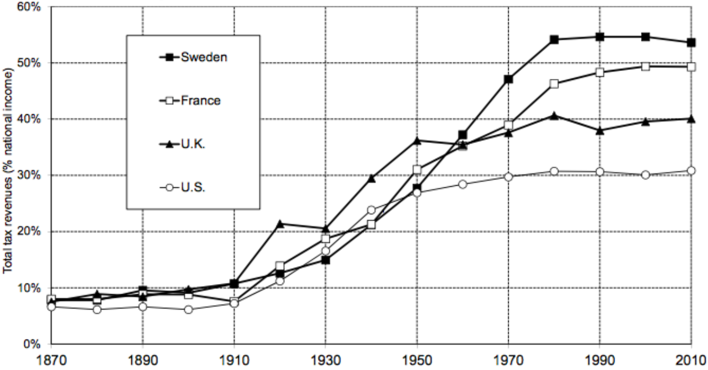
State & Local spending across states



Source: Urban state and local backgrounders

Tax revenue has grown (as a % of GDP) in most countries

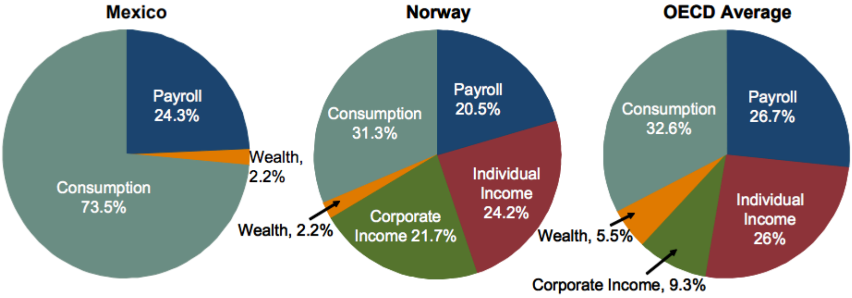
Figure 13.1. Tax revenues in rich countries, 1870-2010



Total tax revenues were less than 10% of national income in rich countries until 1900-1910; they represent between 30% and 55% of national income in 2000-2010. Sources and series: see piketty.pse.ens.fr/capital21c.

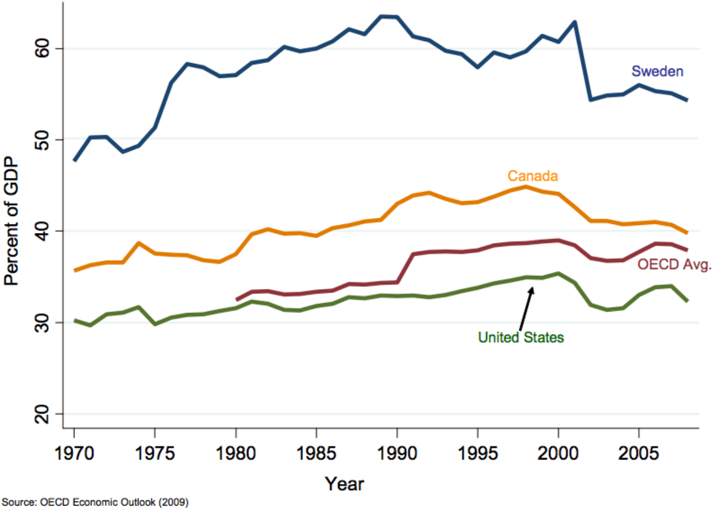
Source: Piketty (2014)

International Tax Rev by Type of Tax (2001, % of Total)



Source: OECD 2002

Gov spending (as % of GDP) varies widely across countries

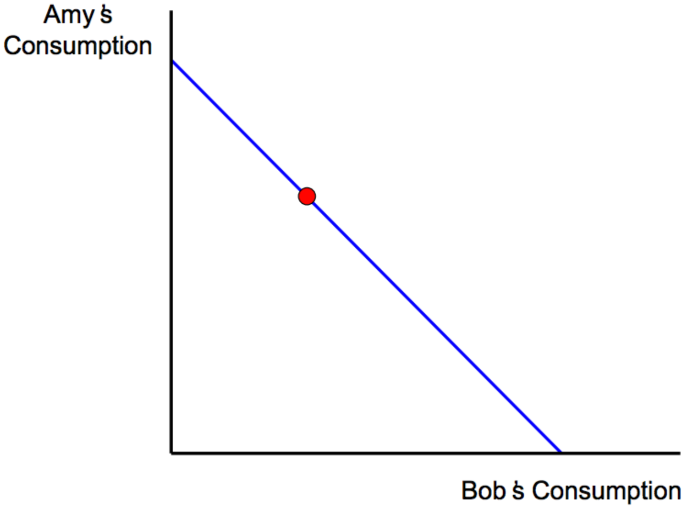


Government Intervention in the Economy

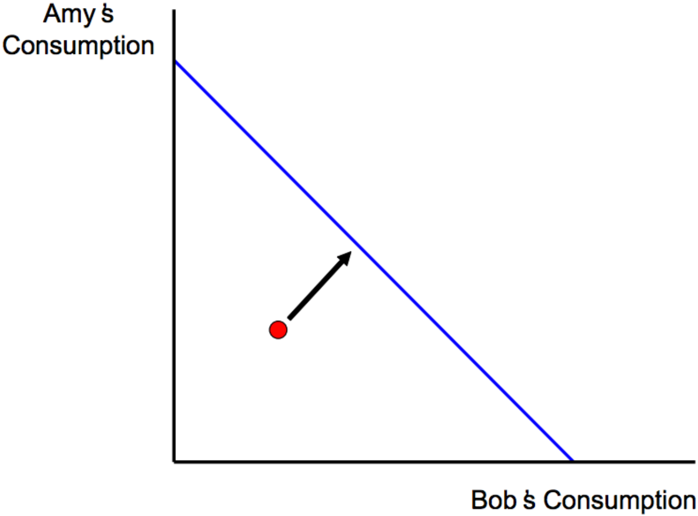
Government Intervention in the Economy

- Organizing framework: "When is government intervention necessary in a market economy?"
  - Market first, govt. second approach
  - Why? Private market outcome is efficient under broad set of conditions (1st Welfare Thm)
- Lecture can be split into two parts:
  1. How can govt. improve efficiency when private market is inefficient?
  2. What can govt. do if private market outcome is undesirable due to redistributional concerns?

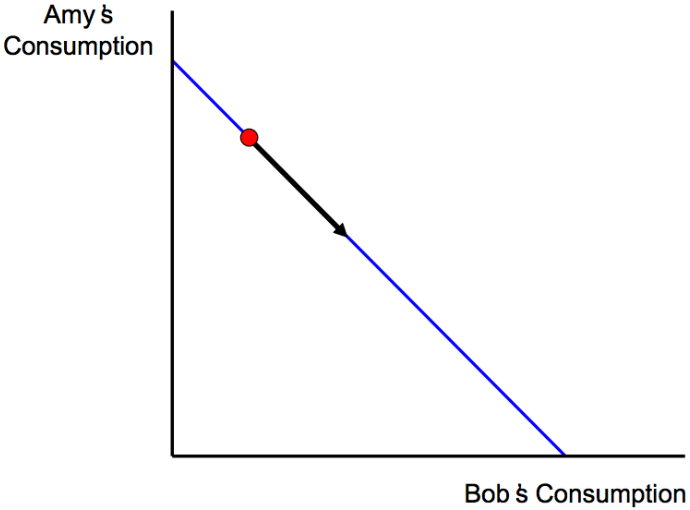
Efficient Private Market Allocation of Goods



First Role for Gov: Improve Efficiency



Second Role for Gov: Improve Distribution



First Welfare Theorem

- Private market provides a Pareto efficient outcome under three conditions:
  1. No externalities
  2. Perfect information
  3. Perfect competition
- Theorem tells us when the government should intervene

Failure 1: Externalities

- Market may be incomplete due to lack of prices (e.g., pollution)
  - Achieving efficient Coasian solution requires an organization to coordinate individuals - that is, a government
- This is why govt. funds public goods (highways, education, defense)
- Questions: What public goods to provide and how to correct externalities?

Failure 2: Asymmetric Information and Incomplete Markets

- When some agents have more information than others, markets fail
- Ex. 1: Adverse selection in health insurance
  - Healthy people drop out of private market $\rightarrow$ unraveling
  - Mandated coverage could make everyone better off
- Ex. 2: capital markets (credit constraints) and subsidies for education
- Ex. 3: Markets for intergenerational goods
  - Future generations' interests may not be fully reflected in market outcomes

Failure 3: Imperfect Competition

- When markets are not competitive, there is role for govt. regulation
  - Ex: natural monopolies such as electricity and telephones
- This topic is traditionally left to courses on industrial organization and is not covered in this course
- But taking the methodological approach of public economics to problems traditionally analyzed in IO is a very promising area

Individual Failures

- If agents do not optimize, government intervention (e.g. by forcing saving via social security) may be desirable
- This is an "individual" failure rather than a market failure
- Conceptual challenge: how to avoid paternalism critique
  - Why does govt. know better what's desirable for you (e.g. wearing a seatbelt, not smoking, saving more)
- Difficult but central issues for optimal policy design

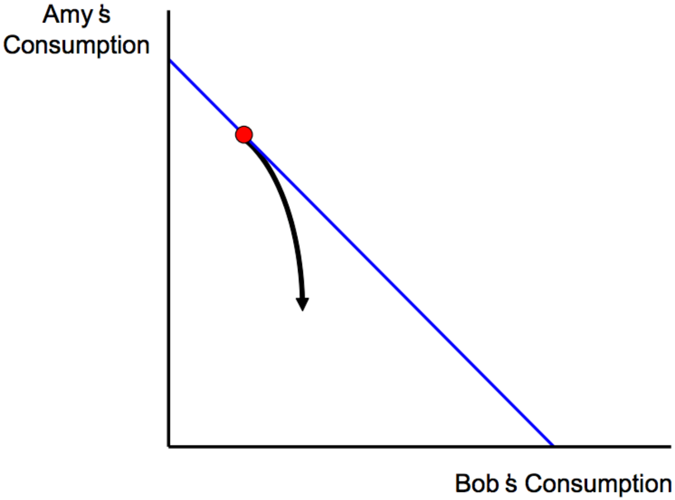
Redistributional Concerns

- Even when the private market outcome is efficient, may not have good distributional properties
- Efficient markets generally seem to deliver very large rewards to small set of people (top incomes)
- Government can redistribute income through tax and transfer system

Why Limit Government Intervention

- One solution to these issues would be for the government to oversee all production and allocation in the economy (socialism).
- Serious problems with this solution
    1. Information: how does government aggregate preferences and technology to choose optimal production and allocation?
    2. Government policies distort incentives (behavioral responses in private sector)
- In practice, there are sharp tradeoffs between costs and benefits of government intervention

Equity-Efficiency Trade-off



Three Types of Questions in Public Economics

1. Positive analysis: What are the observed effects of government programs and interventions?
2. Normative analysis: What should the government do if we can choose optimal policy?
3. Public choice/Political economy
    - Develops theories to explain why the government behaves the way it does and identify optimal policy given political economy concerns
    - Criticism of normative analysis: fails to take political constraints into account

Quick aside on price theory (will use for incidence and efficiency)

Two ways the quantity demanded can change

The quantity demanded can change in two ways:

$$\hat{Q}^D = \underbrace{\hat{D}}_{\text{Shift}} + \underbrace{\varepsilon^D \hat{P}}_{\text{Movement Along}}$$

- $\hat{Q}^D$ is the percentage change in the quantity demanded
- $\hat{D}$ is the shift in demand in percentage terms
- $\hat{P}$ is the percentage change in price
- ε^D is the elasticity of demand

Note that the shift and movement along are in terms of percent changes in **quantities**

Two ways the quantity supplied can change

Similarly, the quantity supplied can change in two ways:

$$\hat{Q}^S = \underbrace{\hat{S}}_{\text{Shift}} + \underbrace{\varepsilon^S \hat{P}}_{\text{Movement Along}}$$

- $\hat{Q}^S$ is the percentage change in the quantity supplied
- $\hat{S}$ is the shift in supply in percentage terms
- $\hat{P}$ is the percentage change in price
- ε^S is the elasticity of supply

Note that the shift and movement along are in terms of percent changes in **quantities**

Simple price theory framework

What do we know?

1. $\hat{Q}^D = \hat{D} + \varepsilon^D \hat{P}$
2. $\hat{Q}^S = \hat{S} + \varepsilon^S \hat{P}$

In equilibrium, the change in quantity demanded and supplied have to be the same:

$$\hat{Q}^D = \hat{Q}^S$$
$$\hat{D} + \varepsilon^D \hat{P} = \hat{S} + \varepsilon^S \hat{P}$$

Implications for Prices and Quantities

The magnitude of price changes reflect four forces:

$$\hat{P} = \frac{\hat{D} - \hat{S}}{\varepsilon^S - \varepsilon^D}$$

We can use this price change to determine the quantity change:

$$\hat{Q} = \hat{S} + \varepsilon^S \left(\frac{\hat{D} - \hat{S}}{\varepsilon^S - \varepsilon^D} \right)$$

$$\hat{Q} = \frac{-\varepsilon^D \hat{S} + \varepsilon^S \hat{D}}{\varepsilon^S - \varepsilon^D}$$

Bottom line: the quantity change is a an elasticity-weighted average of shifts in supply and demand

Equity consequences of taxation

Incidence

Definition

Tax incidence is the study of the effects of tax policies on prices and the distribution of utilities

Incidence

- Ideally, we would characterize the effect of a tax change on utility levels of all agents in the economy
- Useful simplification in practice: aggregate economic agents into a few groups
- Incidence analyzed at a number of levels:
    1. Producer vs. consumer (tax on cigarettes)
    2. Source of income (labor vs. capital)
    3. Income level (rich vs. poor)
    4. Region or country (local property taxes)
    5. Across generations (social security reform)

Key Lessons about Tax Incidence

1. Economic tax incidence separate from "legal incidence"

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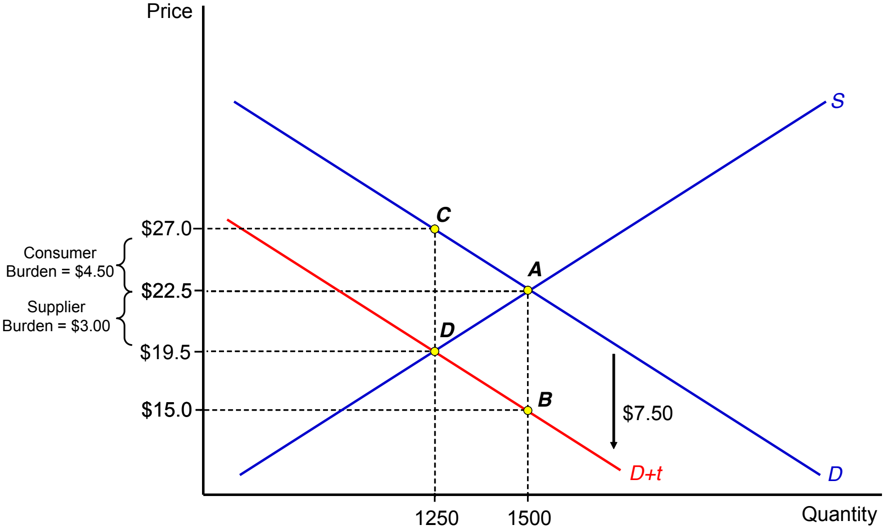
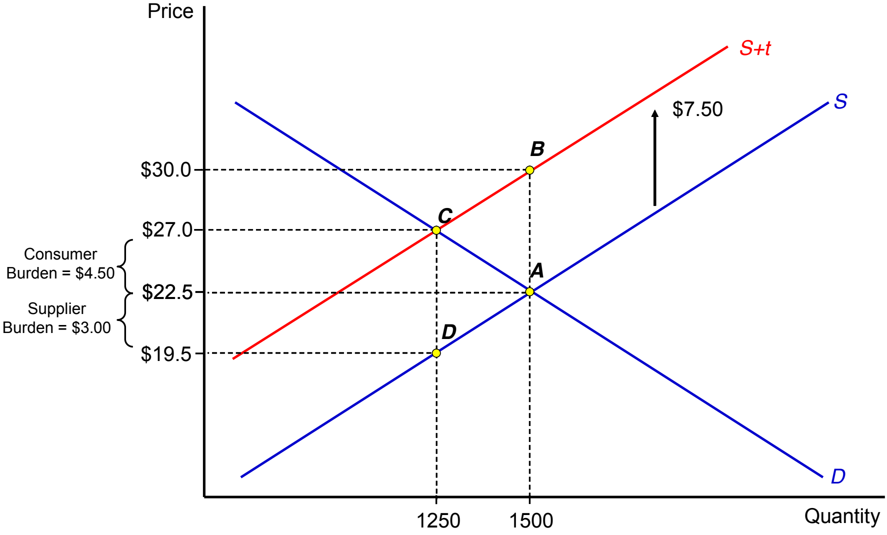
1. Economic tax incidence separate from "legal incidence"
2. Taxing consumers and producers results in same economic impact (If taxes are fully salient (Chetty, Looney, Kroft (2009)). Recall $\hat{P}_D = \hat{P}_S + \tau$)

Tax Levied on Consumers



Tax Levied on Producers



Analytical Framework

We know a three things:

$$\hat{P}_D = \hat{P}_S + \tau$$
$$\hat{Q}^D = \varepsilon^D \hat{P}_D$$
$$\hat{Q}^S = \varepsilon^S \hat{P}_S$$

where $\hat{Q}$ is the percentage change in quantity generated by the tax and τ is also measured in percentage terms

We also have market clearing:

$$\hat{Q}^D = \hat{Q}^S$$
$$\varepsilon^D \hat{P}_D = \varepsilon^S (\hat{P}_D - \tau)$$

Analytical framework: Implications

$$\hat{P}_D = \tau \frac{\varepsilon^S}{\varepsilon^S - \varepsilon^D}$$

$$\hat{P}_S = \tau \frac{\varepsilon^D}{\varepsilon^S - \varepsilon^D}$$

$$\hat{Q} = \tau \frac{1}{\frac{1}{\varepsilon^D} - \frac{1}{\varepsilon^S}}$$

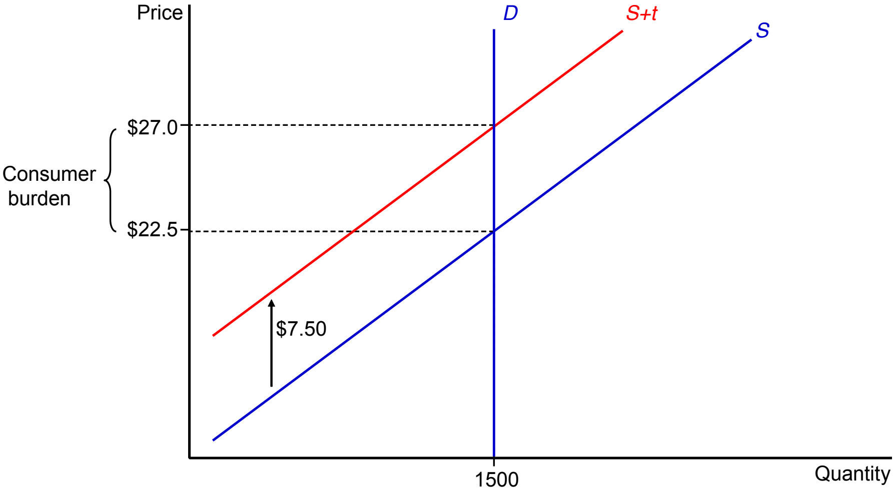
3 Key Lessons about Tax Incidence

1. Economic tax incidence separate from "legal incidence"
2. Taxing consumers and producers results in same economic impact (If taxes are fully salient (Chetty, Looney, Kroft (2009)). Recall $\hat{P}_D = \hat{P}_S + \tau$)
3. Incidence depends on *relative elasticities*
   - The more elastic agent is more able to avoid burden of the tax

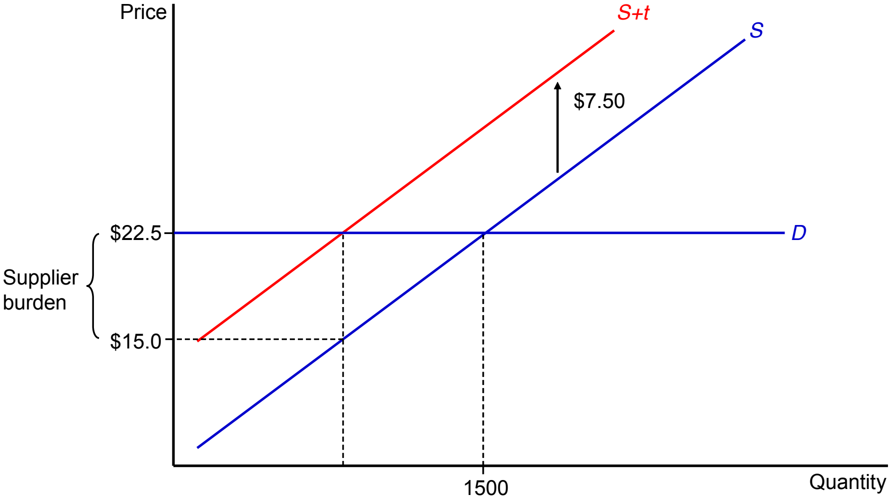
$$\hat{P}_D = \tau \frac{\varepsilon^S}{\varepsilon^S - \varepsilon^D}$$
$$\hat{P}_S = \tau \frac{\varepsilon^D}{\varepsilon^S - \varepsilon^D}$$

   - The ratio $\frac{\hat{P}_D}{\hat{P}_S} = \frac{\varepsilon^S}{\varepsilon^D}$ is the inverse of the elasticities
   - If the demand elasticity is twice as large as the supply elasticity, then sellers pay two-thirds of the tax and buyers pay only one-third

Perfectly Inelastic Demand



Perfectly Elastic Demand



Mandated Benefits

- Tempting to view mandates as additional taxes on firms and apply same analysis as above
- But mandated benefits have different effects on equilibrium wages and employment differently than a tax (Summers 1989)
- Key difference: mandates are a benefit for the worker, so effect on market equilibrium depends on benefits workers get from the program
- Unlike a tax, may have no distortionary effect on employment and only an incidence effect (lower wages)

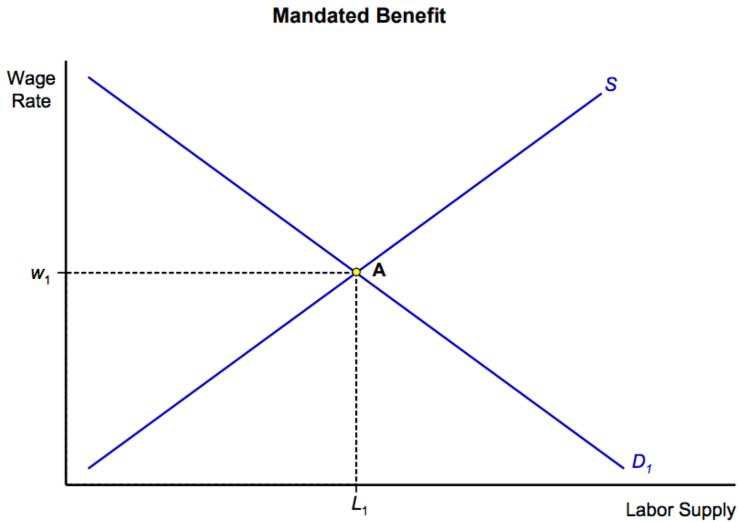
Mandated Benefits: Simple Model

- Labor demand (D) and labor supply (S) are functions of the wage, w
- Initial equilibrium:

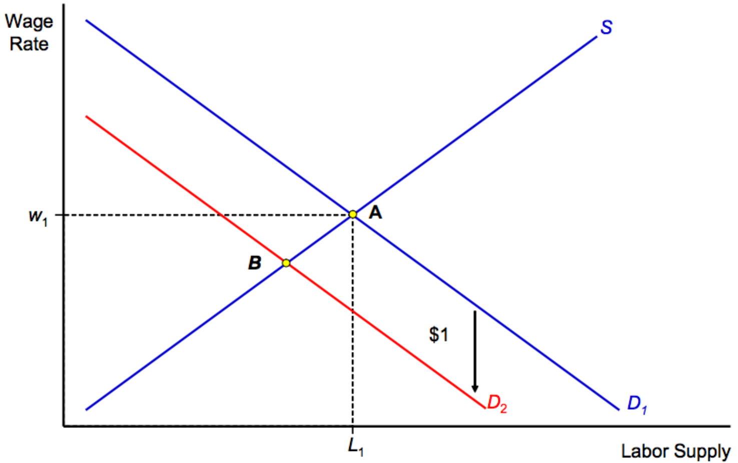
$$D(w_0) = S(w_0)$$

- Now, gov mandates employers provide a benefit with cost t
- Worker value benefit at αt dollars
- Typically $0 < \alpha < 1$, but $\alpha > 1$ possible with market failures
- Labor cost is not $w + t$, effective wage $w + \alpha t$
- New equilibrium:

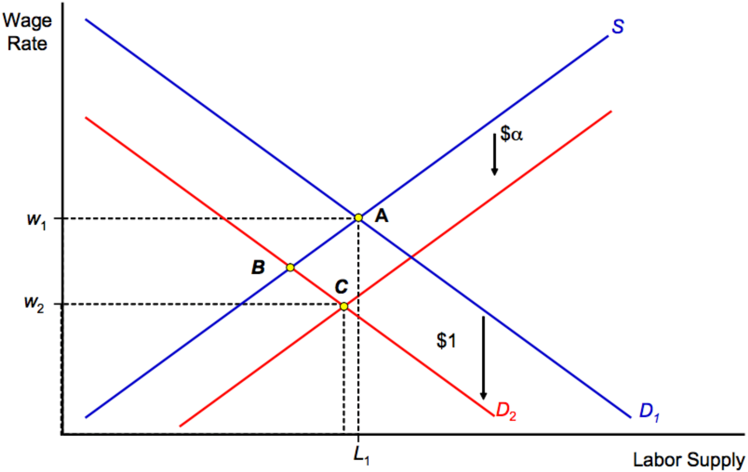
$$D(w + t) = S(w + \alpha t)$$


Mandated Benefit
Wage
Rate
S
w_1
A
D_1
L_1
Labor Supply

Mandated Benefit



Mandated Benefit



Efficiency consequences of taxation

Definition

- Incidence: effect of policies on **distribution** of economic pie
- Efficiency or deadweight cost: effect of policies on **size** of the pie
- Focus in efficiency analysis is on quantities, not prices

References

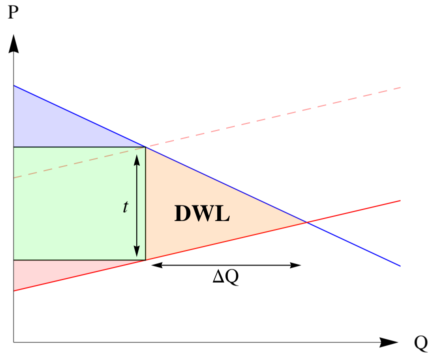
- Auerbach (1985) handbook chapter
- Chetty, Looney, Kroft (AER 2009)
- Chetty (Annual Review 2009)
- Mas-Colell, Whinston, Green Chapter 3 for background on price theory concepts

Efficiency Cost: Introduction

- Government raises taxes for one of two reasons:
  1. To raise revenue to finance public goods
  2. To redistribute income
- But to generate \$1 of revenue, welfare of those taxed falls by more than \$1 because the tax distorts behavior
- How to implement policies that minimize these efficiency costs?
  - Start with positive analysis of how to measure efficiency cost of a given tax system

Deadweight Loss

Marginal cost of taxation increasing in the tax rate

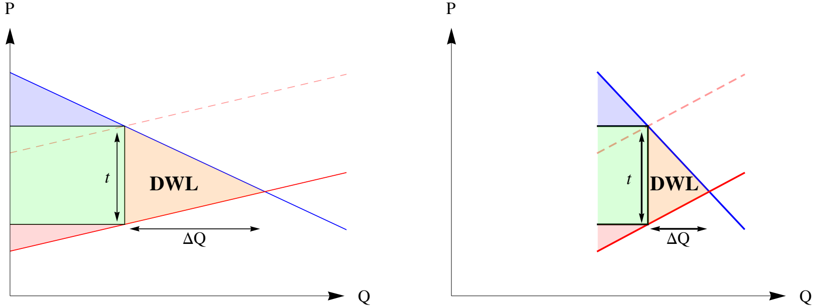


- Deadweight loss is approximately *quadratic* in the tax amount
  - DWL $= \frac{1}{2} t \cdot \Delta Q$
  - ΔQ proportional to t (for linear supply & demand)
  - So DWL goes as t^2

Deadweight Loss

More elastic supply & demand ⇒ More DWL

Two markets with same P & Q, but different supply and demand curves:



- For a given tax t, DWL is bigger if supply & demand are more elastic
  - DWL $= \frac{1}{2} t \cdot \Delta Q$
  - More elastic supply and demand mean larger ΔQ for a given t
  - Intuition: DWL is caused by loss of transactions
    More elastic S&D means more transactions destroyed

Quantitatively, DWL is a triangle (starting from tax=0)

- Base of the triangle (measured vertically) is the change in prices: τP
- The height of the triable (measured horizontally) is the change in quantities: $Q\%\Delta Q$

Social Cost is:

$$
\begin{aligned}
&= \frac{1}{2}\tau PQ\,(\%\Delta Q) \\
&= \frac{1}{2}\tau PQ\left(\tau\frac{1}{\frac{1}{\varepsilon^D}-\frac{1}{\varepsilon^S}}\right) \\
&= \frac{1}{2}\tau^2 \underbrace{PQ}_{\text{Tax Revenue}}\left(\frac{1}{\frac{1}{\varepsilon^D}-\frac{1}{\varepsilon^S}}\right)
\end{aligned}
$$

Social Cost from increasing taxes is: $\frac{\mathrm{d(Social\ Cost)}}{\mathrm{d}\tau} = \tau TR\left(\frac{1}{\frac{1}{\varepsilon^D}-\frac{1}{\varepsilon^S}}\right)$.

Tax	Elasticity of Demand	Elasticity of Supply	Change in Buyer's Price	Change in Seller's price	Change in Output	Social Cost (% of TR)
10%	0.0	0.5	10.0%	0.0%	0.0%	0.0%
10%	0.0	1.0	10.0%	0.0%	0.0%	0.0%
10%	0.0	2.0	10.0%	0.0%	0.0%	0.0%
10%	-0.5	0.0	0.0%	-10.0%	0.0%	0.0%
10%	-1.0	0.0	0.0%	-10.0%	0.0%	0.0%
10%	-2.0	0.0	0.0%	-10.0%	0.0%	0.0%
10%	-0.5	0.5	5.0%	-5.0%	-2.5%	-0.1%
10%	-0.5	1.0	6.7%	-3.3%	-3.3%	-0.2%
10%	-0.5	2.0	8.0%	-2.0%	-4.0%	-0.2%
10%	-1.0	0.5	3.3%	-6.7%	-3.3%	-0.2%
10%	-1.0	1.0	5.0%	-5.0%	-5.0%	-0.3%
10%	-1.0	2.0	6.7%	-3.3%	-6.7%	-0.3%
10%	-2.0	0.5	2.0%	-8.0%	-4.0%	-0.2%
10%	-2.0	1.0	3.3%	-6.7%	-6.7%	-0.3%
10%	-2.0	2.0	5.0%	-5.0%	-10.0%	-0.5%
20%	-1.0	1.0	10.0%	-10.0%	-10.0%	-1.0%
30%	-1.0	1.0	15.0%	-15.0%	-15.0%	-2.3%
40%	-1.0	1.0	20.0%	-20.0%	-20.0%	-4.0%
50%	-1.0	1.0	25.0%	-25.0%	-25.0%	-6.3%

Tax Policy Implications

With many goods, most efficient way to raise revenue is:

1. Tax inelastic goods more (e.g. medical drugs, food), but need to consider effects on other goods and timing (i.e., short run versus long run)
2. Spread taxes across all goods to keep rates relatively low on all goods (broad tax base)

These are two countervailing forces; balancing them requires quantitive measure meant of deadweight loss

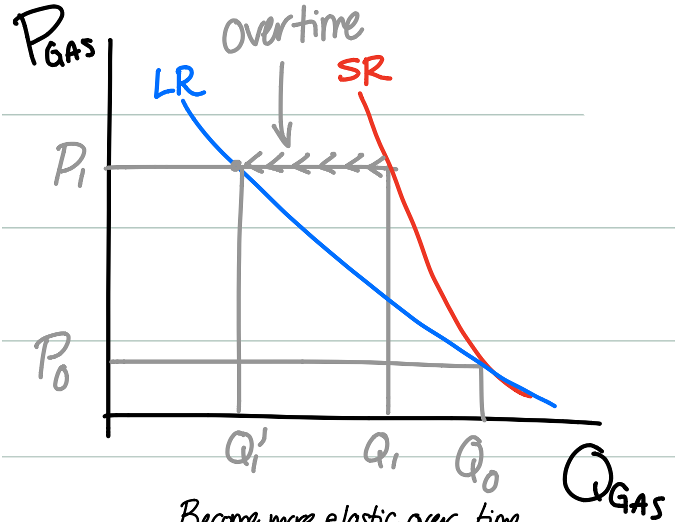
The demand system for gas and cars is:

$$\widehat{GAS} = a\hat{P}_{GAS} + b\hat{P}_{CAR}$$
$$\widehat{CAR} = c\hat{P}_{GAS} + d\hat{P}_{CAR}$$

The long-run elasticity is a, but in short-run people can't adjust as much so there is an indirect impact from the second term, $b\hat{P}_{CAR}$, when the price of gas changes.

Note that $a = \varepsilon_{G,G}$, $b = \varepsilon_{G,C}$, $c = \varepsilon_{C,G}$, and $d = \varepsilon_{C,C}$. Assumed no income growth.

Application: Short Run vs. Long Run Demand for Gas



Become more elastic over time.

Extending the framework to two goods: Gas & Cars

This indirect impact can come from the **demand side**. Let $\widehat{CAR} = 0$.

$$\widehat{GAS} = a\hat{P}_{GAS} + b\hat{P}_{CAR}$$

$$0 = c\hat{P}_{GAS} + d\hat{P}_{CAR} \Rightarrow \hat{P}_{CAR} = \frac{-c}{d}\hat{P}_{GAS}$$

The overall short-run impact of changes in gas prices reflects two forces:

$$\widehat{GAS} = \underbrace{a\hat{P}_{GAS}}_{\text{direct effect}} + \underbrace{b\left(\frac{-c}{d}\hat{P}_{GAS}\right)}_{\text{indirect effect}}$$

Takeaways:

1. Gas price declines can bid up the price of cars, which can reduce overall responsiveness of $\widehat{GAS}$ to $\hat{P}_{GAS}$ in the short-run
2. The magnitude of the difference depends on the strength of complementarity (which comes from b and c)

Extending the framework to two goods: Gas & Cars

- The **supply side** will respond to high car prices eventually too
- Let $\widehat{CAR} = \varepsilon^S \hat{P}_{CAR}$.

$$\widehat{GAS} = a\hat{P}_{GAS} + b\hat{P}_{CAR}$$
$$\varepsilon^S \hat{P}_{CAR} = c\hat{P}_{GAS} + d\hat{P}_{CAR} \Rightarrow \hat{P}_{CAR} = \frac{c}{\varepsilon^S - d}\hat{P}_{GAS}$$

The overall short-run impact of changes in gas prices reflects two forces:

$$\widehat{GAS} = \underbrace{a\hat{P}_{GAS}}_{\text{direct effect}} + \underbrace{b\left(\frac{c}{\varepsilon^S - d}\hat{P}_{GAS}\right)}_{\text{indirect effect}}$$

Takeaways:

1. The indirect effect on gas depends on the supply elasticity of cars.
2. If $\varepsilon^S = 0$, then we get the result from the last slide.
3. If $\varepsilon^S = \infty$, then $\hat{P}_{CAR} = 0$ and $\varepsilon^{LR} = a$.

Incidence Example: Cabral, Geruso, Mahoney, AER 2018