Lecture 6: Tax Incidence

October 3, 2023

Course Administration

1. Reminder: midterm October 17
   - Last year's midterm posted
   - Midterm review: Wednesday October 11, 7:00 to 8:30 in Gelman 402
   - Huang will record if you cannot make it
   - Will work through old midterm
2. Final is your choice of Dec. 13 or 14: 3:30 to 5:30. MPA 601Z

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3. Will grade Use Numbers 2 by next week
4. Any questions?

Next Week: Ripped from the Headlines

As a reminder, next week

Finder	Presenter
Trenton	Kari

Ripped from the Headlines

This week

Finder	Presenter
Marissa	Yolanda

Today on Taxation

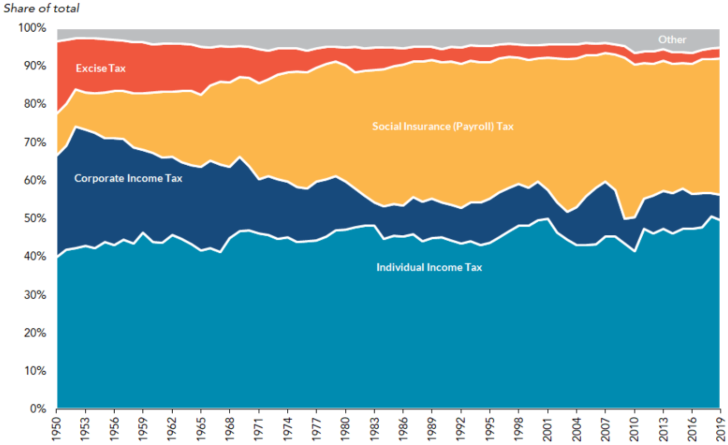
1. Taxation overview
2. Three rules of tax incidence
3. Tax incidence extensions
4. General equilibrium tax incidence
5. Empirical evidence on tax incidence

Taxation Overview

Many Types of Taxation

- Payroll tax
- Income tax
- Corporate tax
- Wealth taxes
  - Property tax
  - Estate tax
- Consumption tax
  - Sales tax
  - Excise tax – sales tax applied only to certain goods
  - Value added tax

Method of Taxation Has Shifted Dramatically in US



With thanks to the Tax Policy Center, and the OMB for data. [See here.]

Key Tax Definitions

- Tax base: that on which the tax is levied
  - Base for property tax is value of properties
  - Base for sales tax is value of sales
- Tax rate: rate at which base is taxed
  - DC's General tangible property and selected services tax rate is 5.75%
  - DC's parking tax rate is 18%

Three Rules of Tax Incidence

You Levy a Tax – Who Pays?

The US income tax has shifted from a reliance on corporate taxes to income tax. Does this mean workers are paying more? "Who pays?" $=$ tax incidence

You Levy a Tax – Who Pays?

The US income tax has shifted from a reliance on corporate taxes to income tax. Does this mean workers are paying more? "Who pays?" $=$ tax incidence

Study the three rules of tax incidence

1. Statutory burden of tax $\neq$ economic incidence of tax
2. Side of the market on which tax is imposed is irrelevant to distribution of tax burdens
3. Parties with inelastic supply or demand bear taxes

Types of Taxation

- specific excise tax: per unit tax
- ad valorem tax: tax that is a fixed percentage of the sale price

We will present everything with a specific excise tax. Results are equally applicable to an ad valorem tax.

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U.S. excise tax examples

- federal tax on bows, archery equipment and and arrow shafts
- gasoline
- wine, varying by type, highest on “naturally sparkling”

Key Phrases

Incidence $\equiv$ who pays the tax, or who "bears the burden" of the tax.

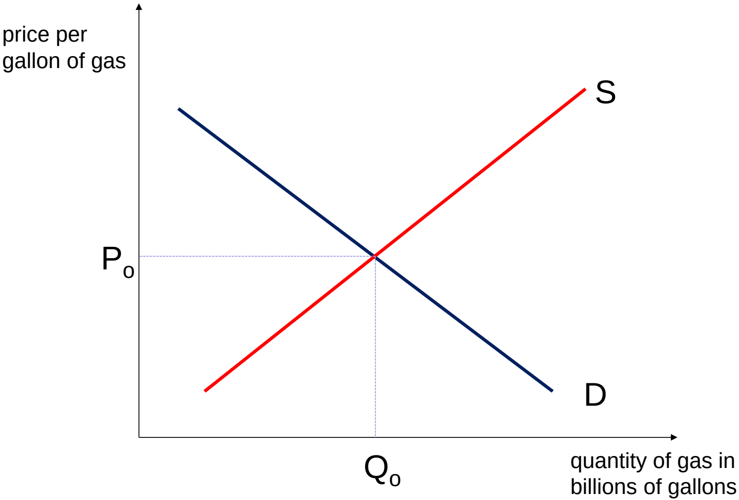
- Statutory incidence: determined by who pays the tax to the government
- Economic incidence: determined by whose economic resources change due to the tax

Measurement of Incidence

- We measure incidence in price terms
- This assumes that changes in quantities are *de minimis*

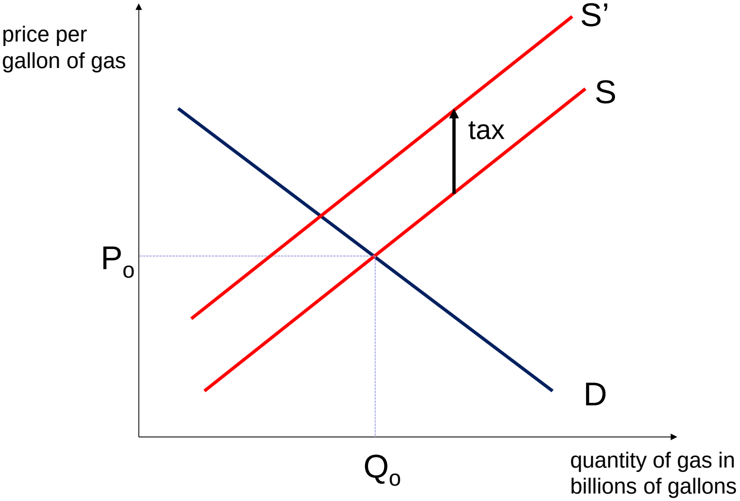
1. Statutory Incidence $\neq$ Economic Incidence

What Happens When you Levy a Tax on the Producer?



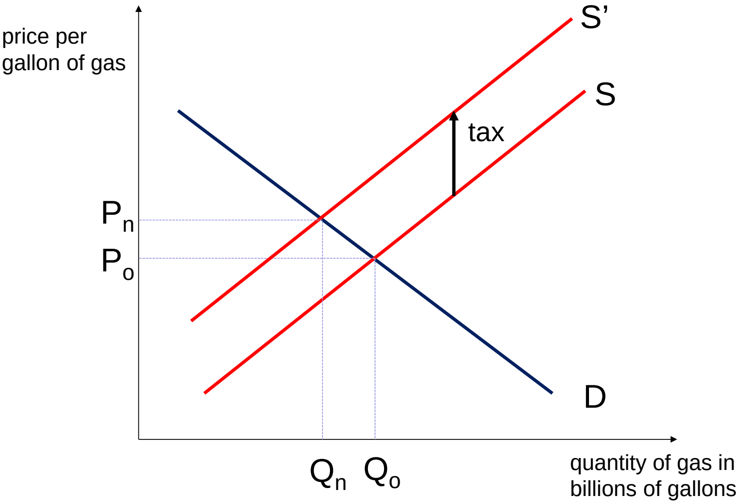
1. Statutory Incidence $\neq$ Economic Incidence

What Are the New Equilibrium Price and Quantity?



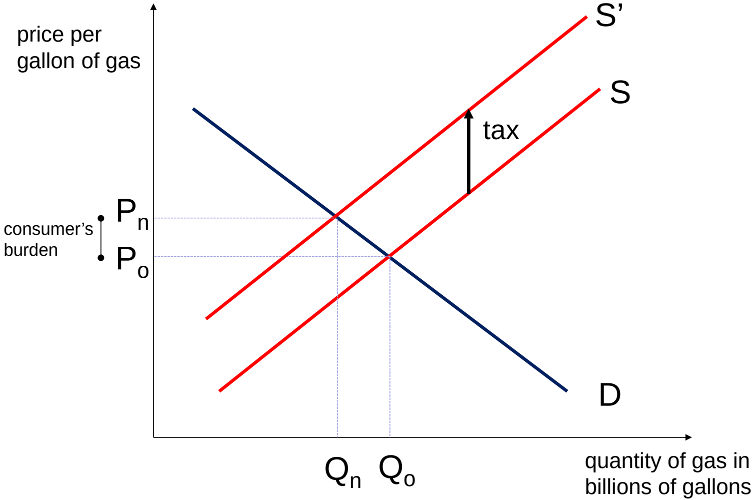
1. Statutory Incidence $\neq$ Economic Incidence

How Much Extra is the Consumer Paying?



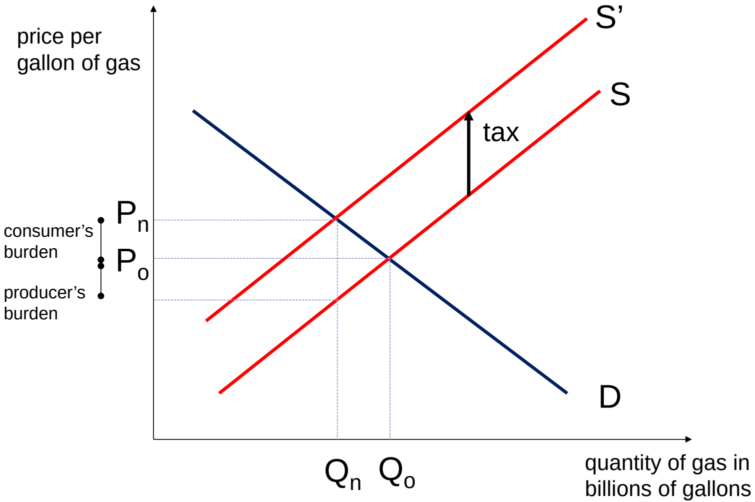
1. Statutory Incidence ≠ Economic Incidence

How Much Does the Producer Sell for? And What Does He Keep?



1. Statutory Incidence $\neq$ Economic Incidence

Producer and Consumer Share the Burden of the Tax



Defining Tax Burdens

- a burden is a bad thing for producers or consumers
- burden is expressed as a positive number
- think of it as the net effect of positive and negative price changes from the tax
- from the producer and consumer viewpoint separately
- producer and consumer tax burden sum to the amount of the tax

Defining Tax Burdens, Tax on Producer

- consumer tax burden
  = (post-tax price - pre-tax price) + per-unit tax payment by consumer
  = benefit/loss in price change to consumer + per-unit tax payment by consumer
  $= (P_n - P_o) +$ per-unit tax payments by consumers
  $= P_n - P_o$

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  $= P_n - P_o$
- producer tax burden
  = (pre-tax price - post-tax price) + per-unit tax payment by producer
  = per-unit tax payment by producer + benefit/loss in price change to producer
  = per-unit tax payments by producers $-(P_n - P_o)$
  $= \text{tax} - (P_n - P_o)$

Writing the New Supply Curve

- Suppose that the supply curve before the tax is $Q = 2P - 2$.
- What is the new supply curve that includes a tax of \$2/unit?

Writing the New Supply Curve

- Suppose that the supply curve before the tax is $Q = 2P - 2$.
- What is the new supply curve that includes a tax of \$2/unit?
- Note that P-intercept on the new supply curve shifts upward by the amount of the tax

Writing the New Supply Curve: Equations

- The original supply curve is $Q = 2P_{bt} - 2$
  - re-write in terms of P: $P_{bt} = 1 + (1/2)Q$
- Note that $P_{at} = P_{bt} + 2$
  - supply curve shifts up by 2
- So we can write the after-tax supply curve as

$$\begin{aligned} P_{at} &= 1 + (1/2)Q + 2 \\ &= 3 + (1/2)Q \end{aligned}$$

- Note that you can re-write this as $Q = 2P_{at} - 6$

An Alternative Method to Finding New Supply

- The same original supply curve: $Q_S = 2P_{bt} - 2$.
- How does the supplier perceive a tax of \$2/unit?
  - $P_{at} = P_{bt} + 2 \rightarrow P_{bt} = P_{at} - 2$
  - where *at* denotes the after tax price *bt* the before tax price in the supply curve

An Alternative Method to Finding New Supply

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  - $P_{at} = P_{bt} + 2 \rightarrow P_{bt} = P_{at} - 2$
  - where *at* denotes the after tax price *bt* the before tax price in the supply curve
- We'd like to know market supply as a function of the taxed price: $Q_S^{tax} = f(P)$

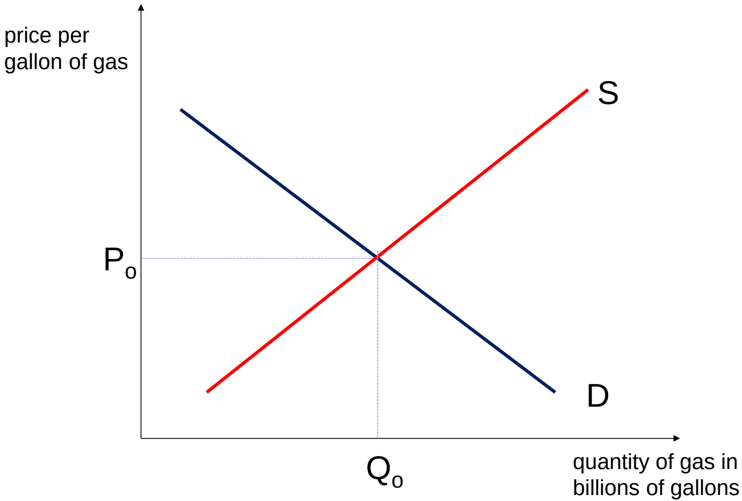
$$\begin{aligned} Q_S^{tax} &= 2P_{bt} - 2 \\ Q_S^{tax} &= 2(P_{at} - 2) - 2 \\ Q_S^{tax} &= 2P_{at} - 4 - 2 = 2P_{at} - 6 \end{aligned}$$

2. Side of the Market on Which Tax is Imposed Irrelevant to Distribution of Tax Burden

- Suppose that the gasoline tax is levied on the consumer, not the producer
- This means you buy some gas and send a check to the government

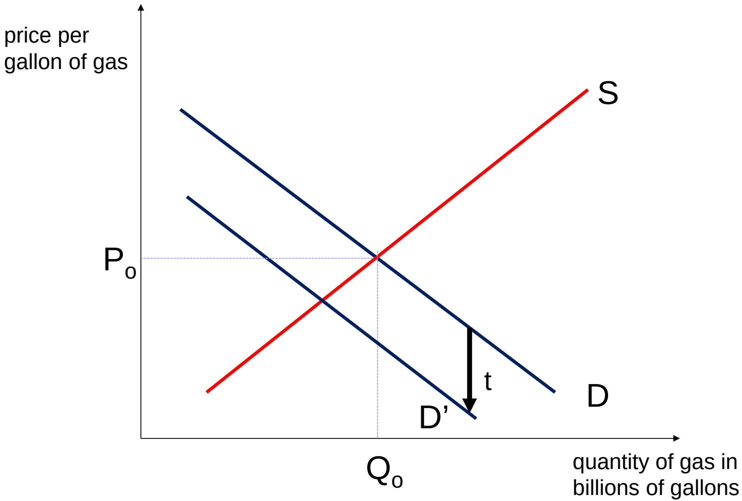
Consumer Pays Tax

What Happens When you Levy a Tax on the Consumer?



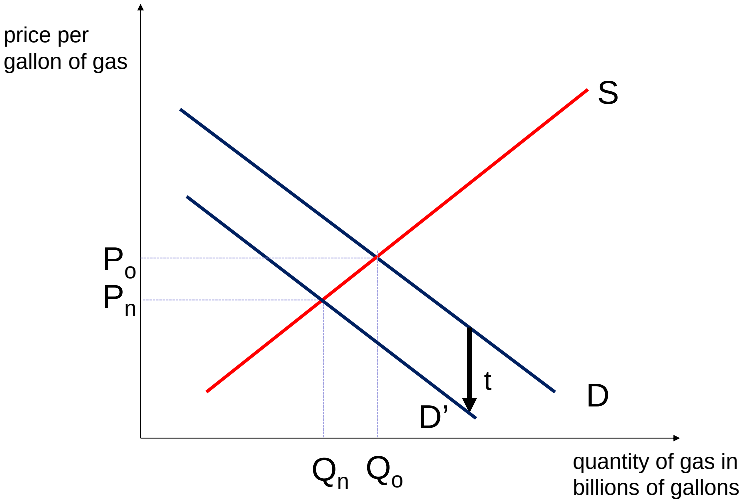
Consumer Pays Tax

What Are the New Equilibrium Price and Quantity?



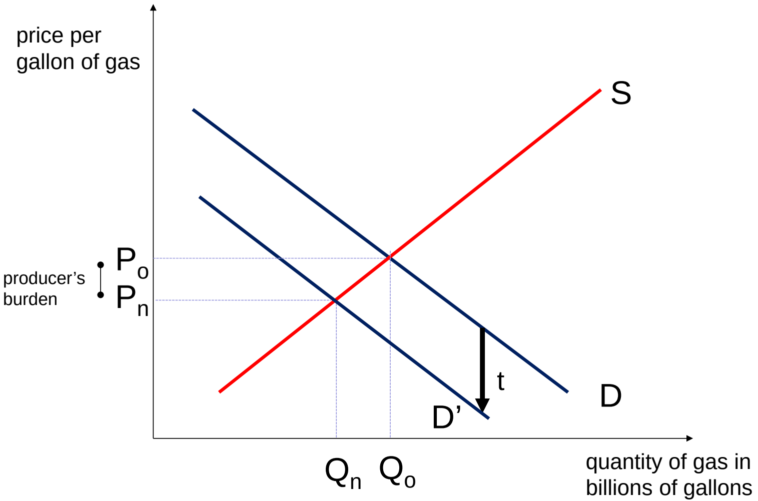
Consumer Pays Tax

How Much Lower Price Does the Producer Suffer?



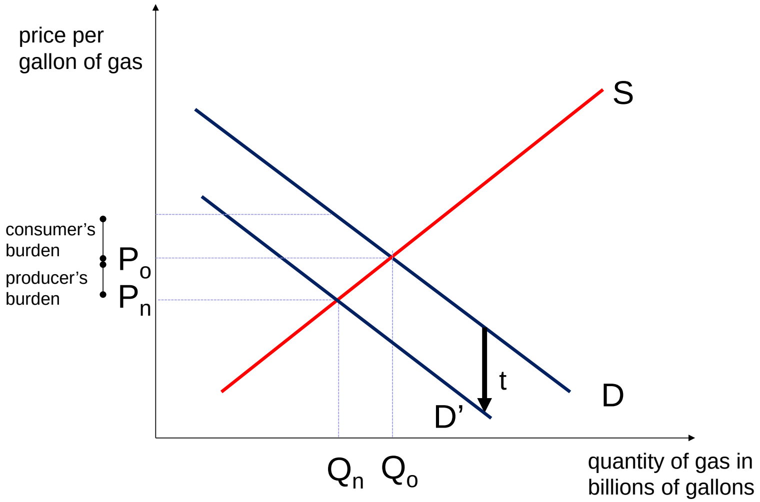
Consumer Pays Tax

How Much Does the Consumer Pay?



Consumer Pays Tax

Producer and Consumer Share the Burden of the Tax



Consider Burdens

- When tax is levied on consumers
  - consumer burden

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  - consumer burden $= t - (P_o - P_n)$
  - producer burden

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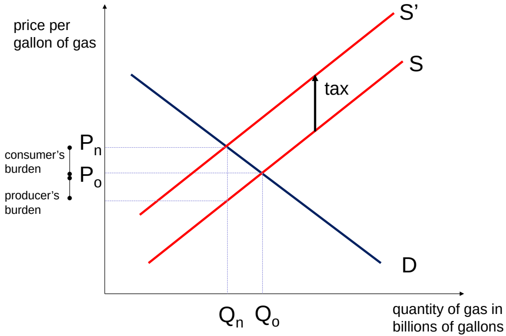
  - total burden $= P_n - P_o + t - (P_n - P_o) = t$
- Note that
  - In both cases, total burden is tax. t
  - The total price change faced by producers and consumers is equal regardless of the side of the market with the tax

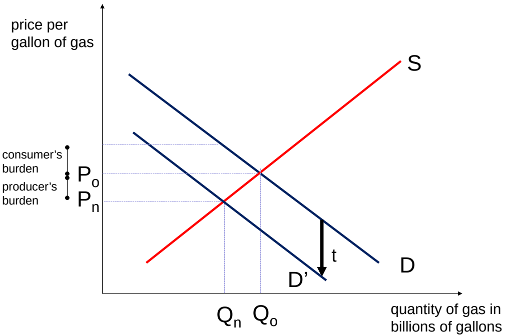
Visual Comparison of Burdens

Statutory incidence falls on

Producers



Consumers



Tax Wedge

- Tax wedge is sum of consumer and producer burdens
- Does the wedge change if the tax is levied on consumers?

In-Class Problem

The demand for rutabagas is $Q = 1,900 - 100P$, and the supply of rutabagas is $Q = 300P - 100$.

1. Find the original equilibrium price
2. Re-write one of the curves if the producer bears the statutory incidence of a \$4/unit tax on the sale of rutabagas.
3. Find the post-tax equilibrium price.
4. Find the consumer burden.
5. Find the producer burden.
6. Describe who bears the economic incidence of this tax.

In-Class Problem Answer, Part 1

1. Original equilibrium is

$$\begin{aligned} 1900 - 100P &= 300P - 100 \\ 2000 &= 400P \\ P &= 5 \end{aligned}$$

In-Class Problem Answer, Part 1

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2. A tax on the sale means that the producer's price is now 4 above the market price
   - $P_{at} = P_{bt} + 4$
   - Original supply curve is $Q_s = 300P_{bt} - 100$
   - Re-write supply as

$$\begin{aligned} Q_S &= 300P_{bt} - 100 \\ Q_S &= 300(P_{at} - 4) - 100 \\ Q_S &= 300P_{at} - 1200 - 100 \\ Q_S &= 300P_{at} - 1300 \end{aligned}$$

In-Class Problem Answer, Part 2

3. The new equilibrium sets the new supply equal to new demand
   - Put the demand and supply together: $300P - 1300 = 1900 - 100P$, or $P = 8$.

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In-Class Problem Answer, Part 2

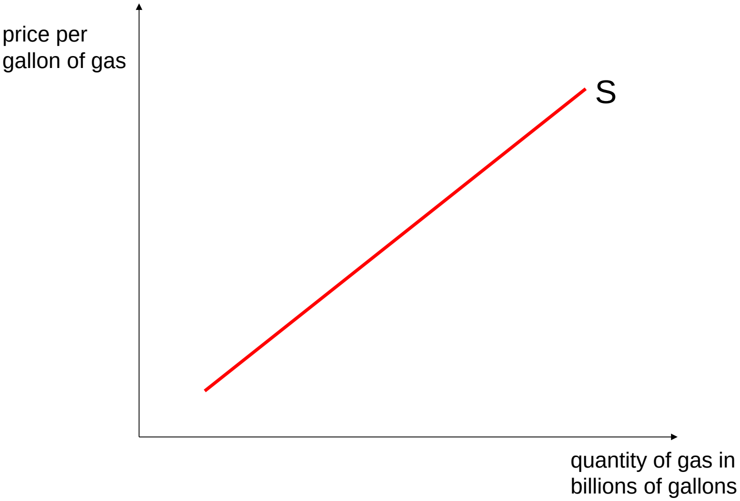
3. The new equilibrium sets the new supply equal to new demand
   - Put the demand and supply together: $300P - 1300 = 1900 - 100P$, or $P = 8$.
4. Consumer burden: price increase of \$3
5. Producer burden: tax of \$4, minus price increase of \$3: $4 - 3 = 1$
6. Economic incidence of tax is shared

3. Inelastic Party Bears Tax Burden

- Return to statutory tax burden levied on producers
- Consider inelastic demand
- Consider elastic demand

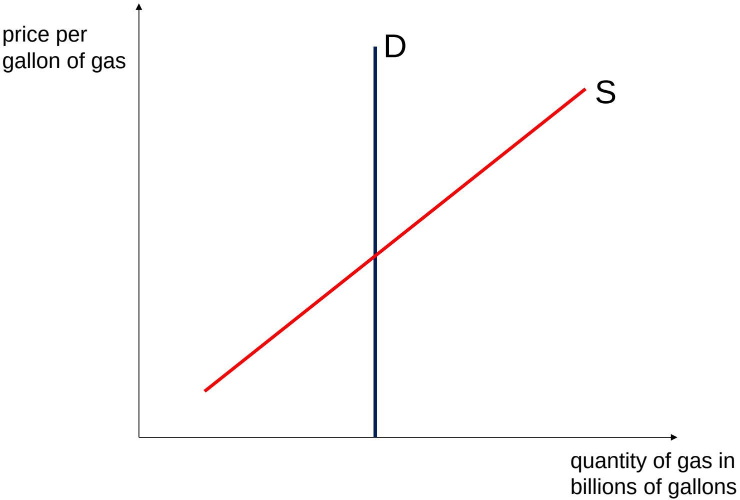
Inelastic Demand

What Does Inelastic Demand Look Like?



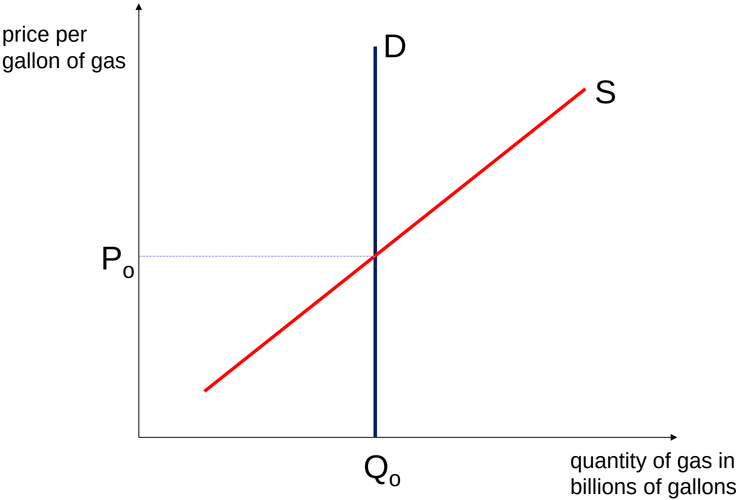
Inelastic Demand

What is the Original Equilibrium P and Q?



Inelastic Demand

How Does the Tax Shift Production?



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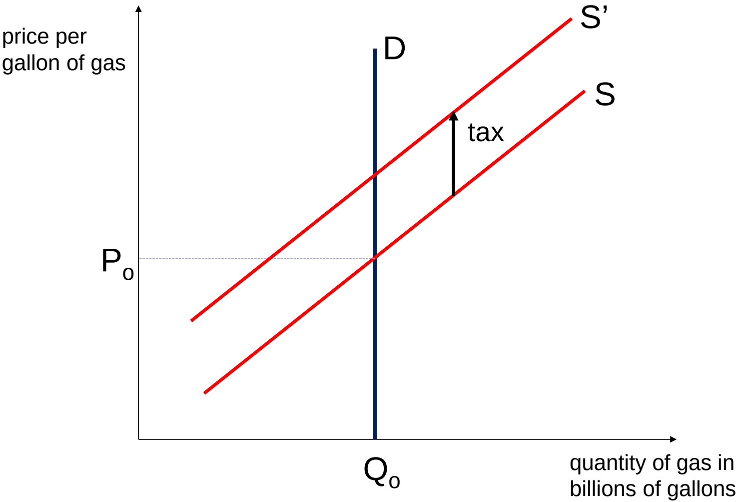
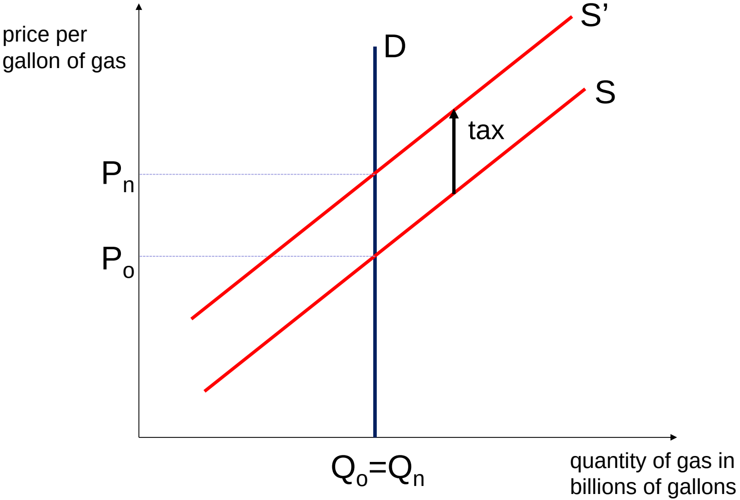


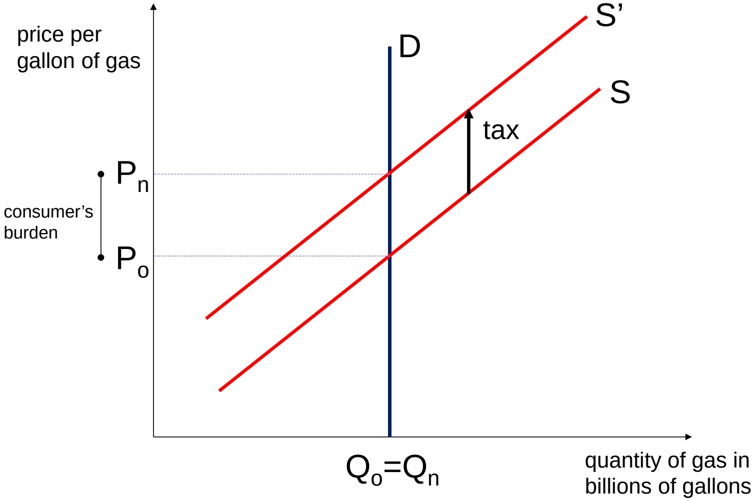
Inelastic Demand

What is the Consumer's Burden?



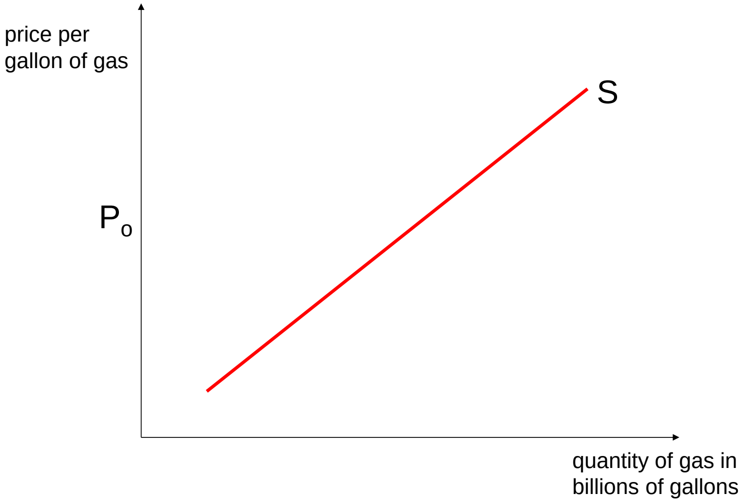
Inelastic Demand

Consumer Cannot Run Away From Tax



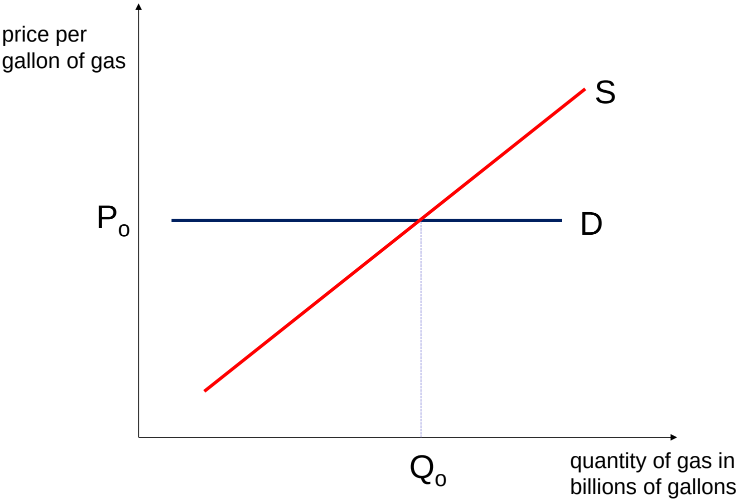
Elastic Demand

What Does Elastic Demand Look Like?



Elastic Demand

How Does Tax on Producer Shift Supply?



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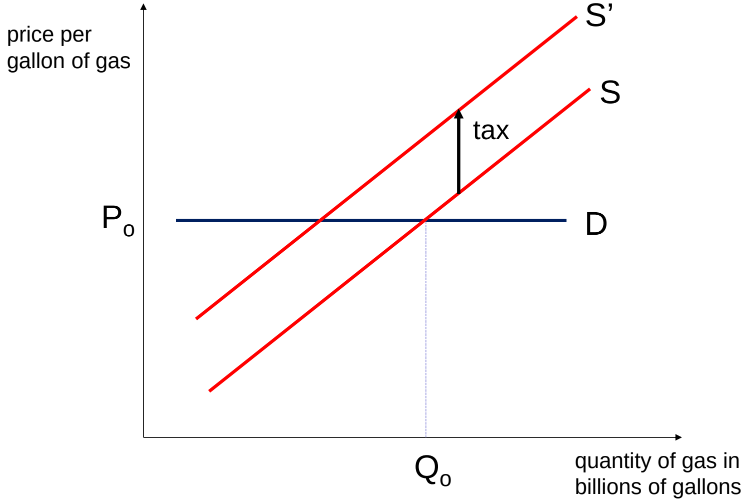
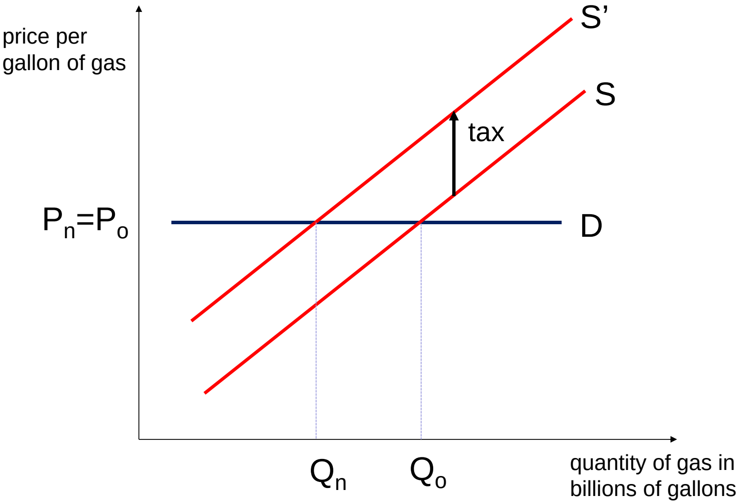
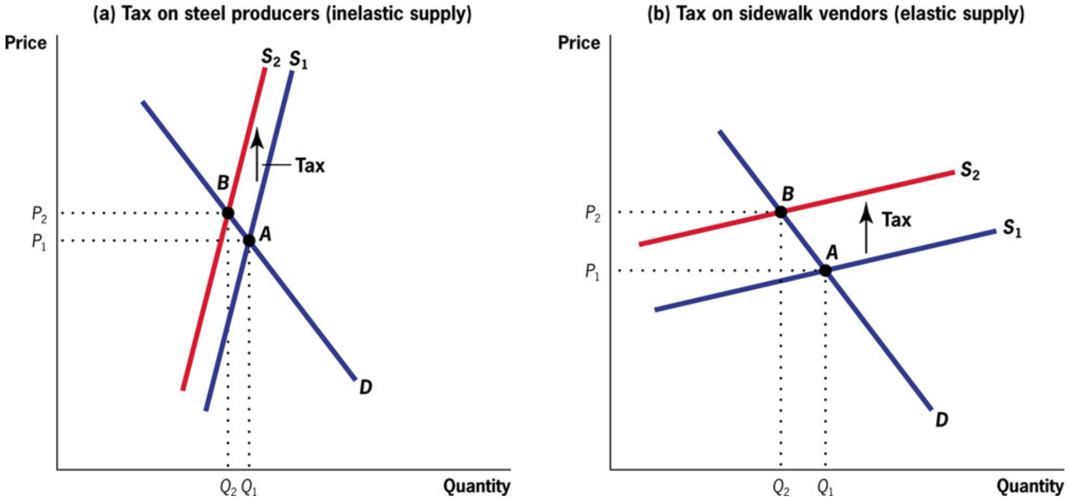


Elastic Demand

Producer Bears Entire Burden



And the Same is True for Supply



Tax Incidence Extensions

Three Extensions

1. Tax incidence in factor markets
2. (skip) Tax incidence in imperfectly competitive markets
3. (skip) Balanced budget tax incidence

Tax Incidence in Factor Markets

- Suppose a tax is levied on a factor of production
  - tax on labor
  - tax on capital, such as land or steel

Tax Incidence in Factor Markets

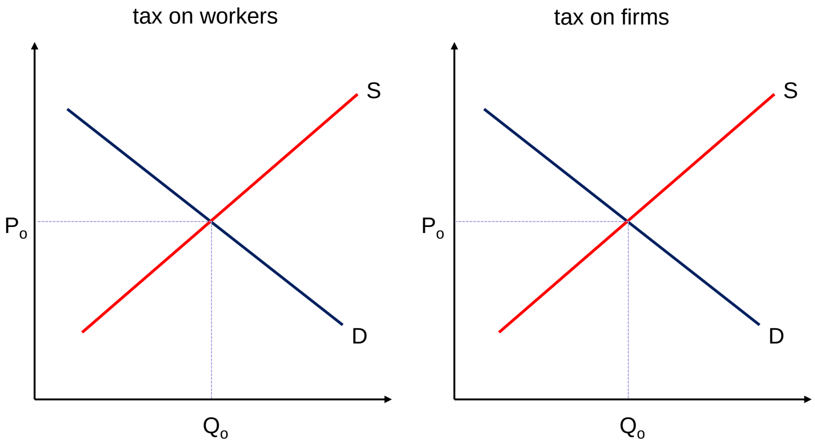
- Suppose a tax is levied on a factor of production
  - tax on labor
  - tax on capital, such as land or steel
- Do wages decrease? Or do product prices increase?
- Who bears the burden of the tax?

Tax on Workers

- Suppose the government decides to levy a tax on workers
- It can either charge workers via a payroll tax
- Or it can charge employers via a payroll tax
- Does it matter?

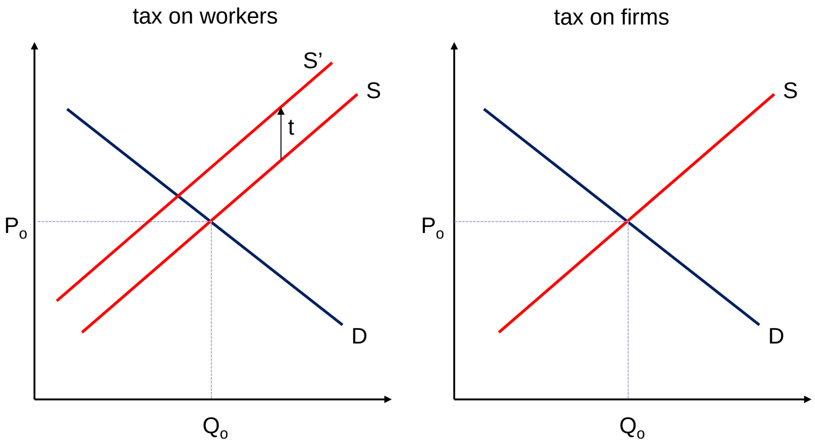
Tax on Workers (Producers) vs. Tax on Firms (Consumers)

How Does Tax on Workers (=Producers) Shift Supply?



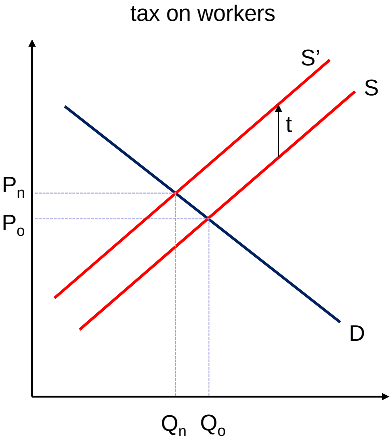
Tax on Workers (Producers) vs. Tax on Firms (Consumers)

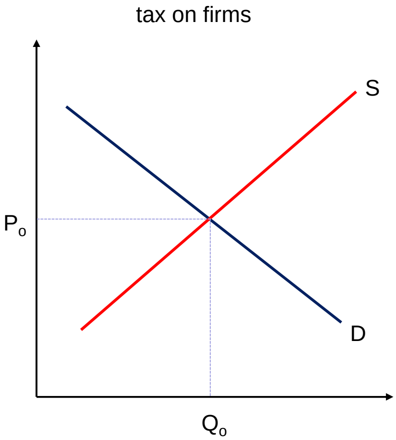
What Are the New Equilibrium P and Q?



Tax on Workers (Producers) vs. Tax on Firms (Consumers)

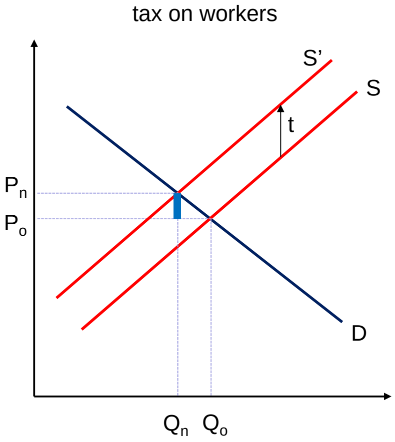
What is the Consumer (Labor Purchaser) Burden?

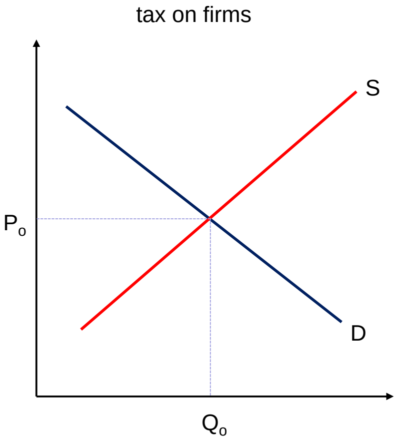




Tax on Workers (Producers) vs. Tax on Firms (Consumers)

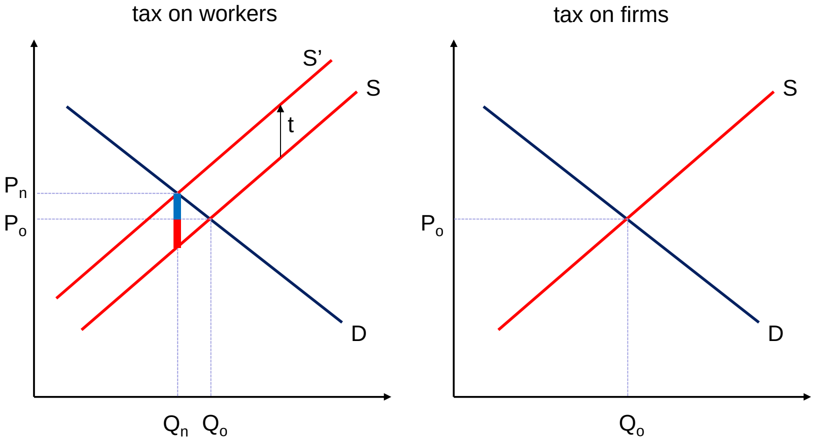
What is the Producer (Worker/Supplier) Burden?





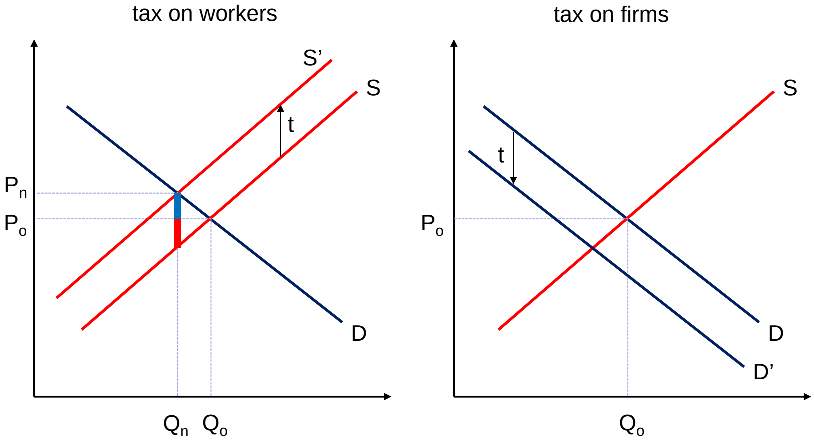
Tax on Workers (Producers) vs. Tax on Firms (Consumers)

What if Firms Pay the Payroll Tax?



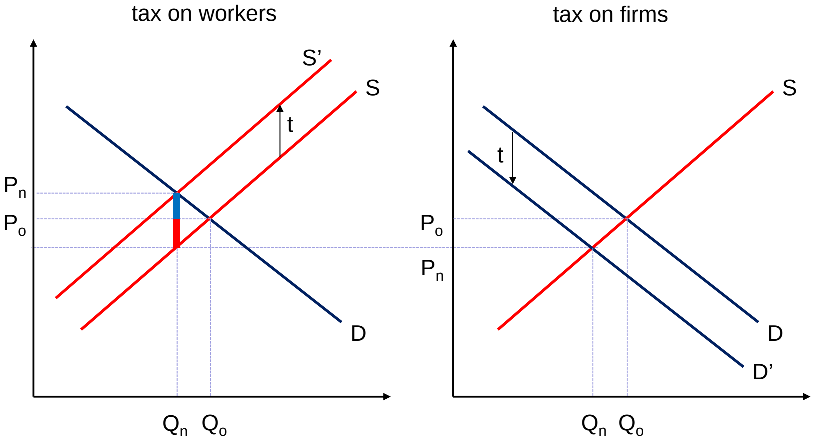
Tax on Workers (Producers) vs. Tax on Firms (Consumers)

New Equilibrium P and Q?



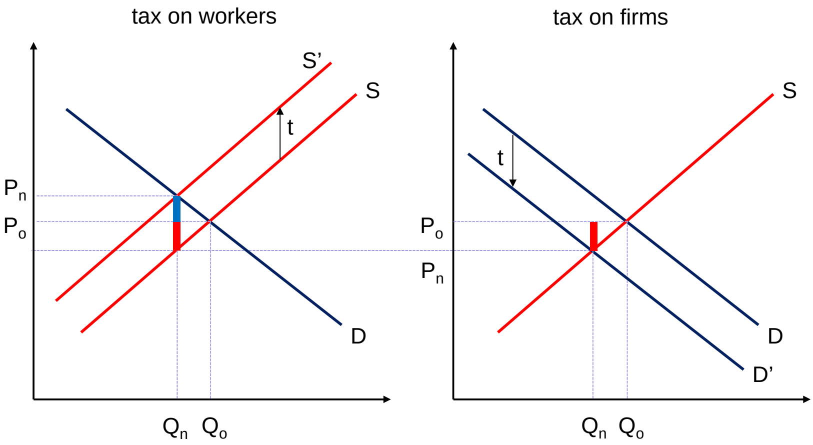
Tax on Workers (Producers) vs. Tax on Firms (Consumers)

Producer (Worker) Burden?



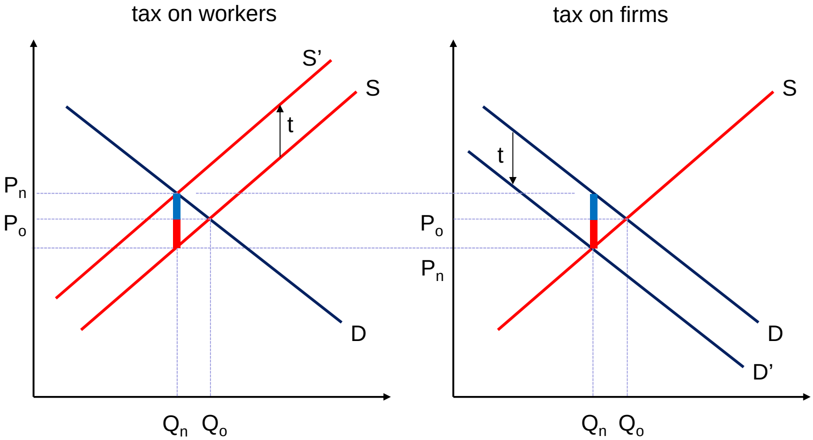
Tax on Workers (Producers) vs. Tax on Firms (Consumers)

Consumer (Labor Purchaser) Burden?



Tax on Workers (Producers) vs. Tax on Firms (Consumers)

Doesn't Matter Who Pays the Tax

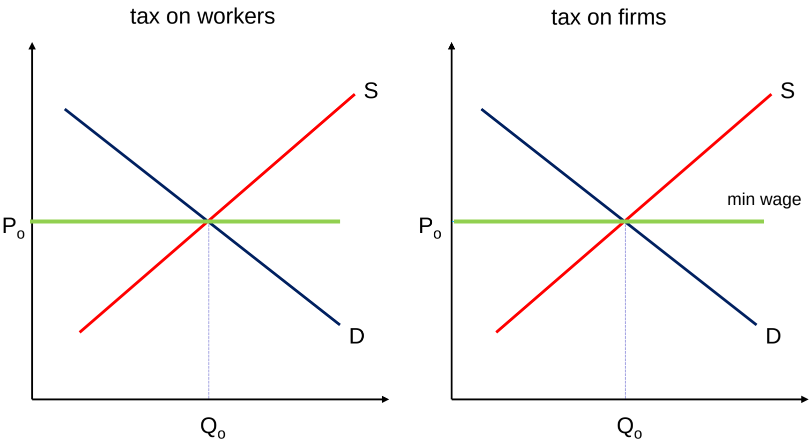


But What If There is an Impediment to Adjustment?

- Suppose that there is a minimum wage
- Compare payroll tax levied on workers
- To payroll tax levied on employers

Tax with a Minimum Wage

How Does Tax on Workers=Producers Shift Supply?



Tax with a Minimum Wage

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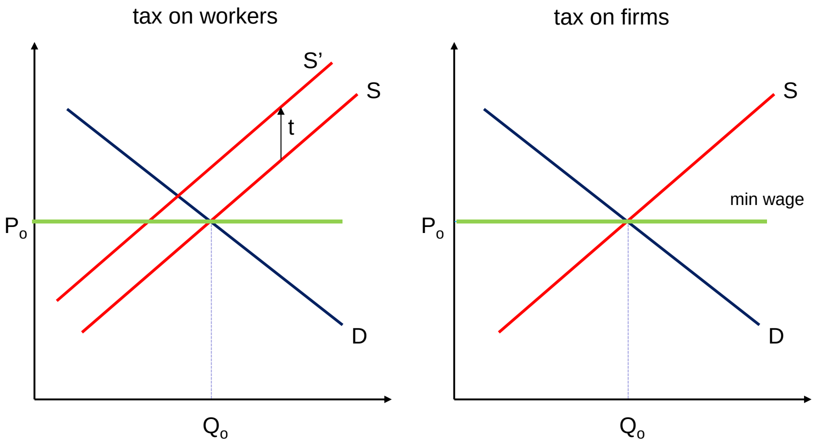
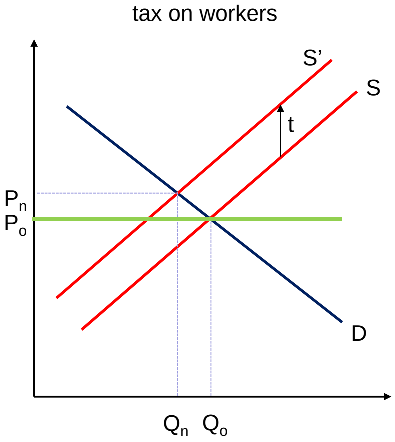
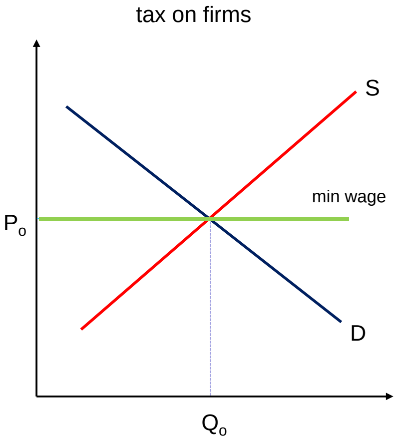


Tax with a Minimum Wage

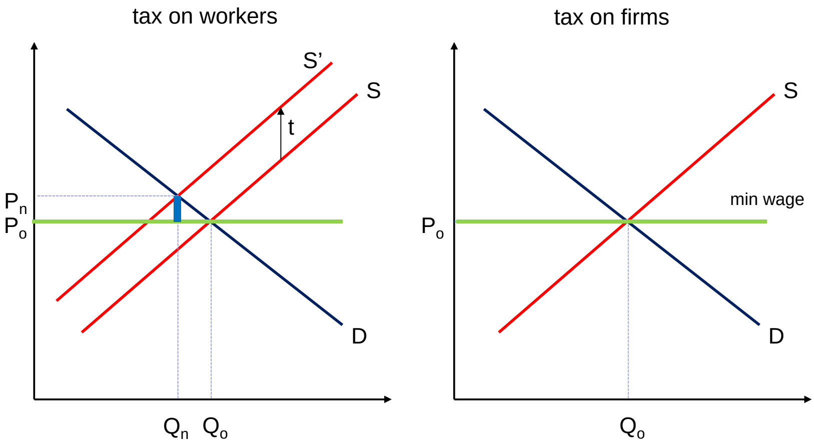
What is the Consumer (Labor Purchaser) Burden?





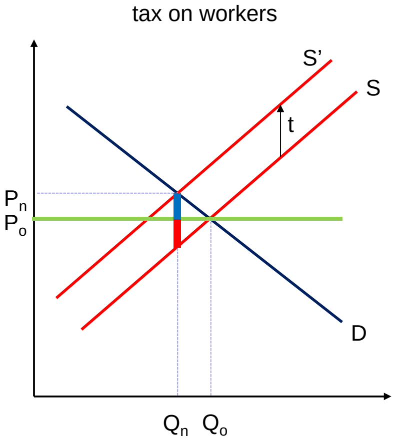
Tax with a Minimum Wage

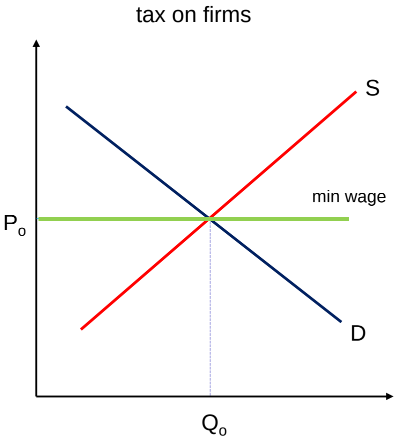
What is the Producer (Worker Supplier) Burden?



Tax with a Minimum Wage

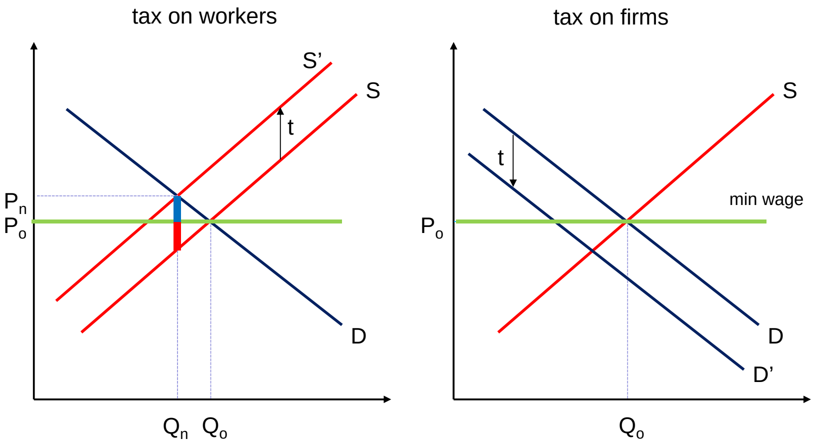
What if Firms Pay the Payroll Tax?





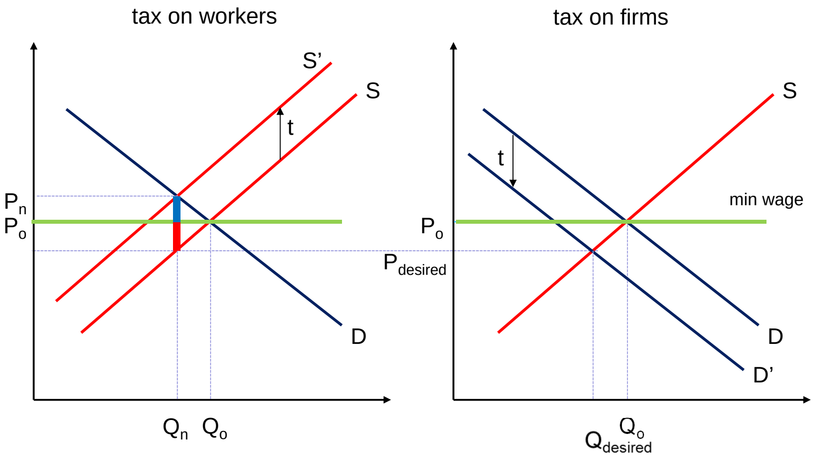
Tax with a Minimum Wage

New Equilibrium P and Q?



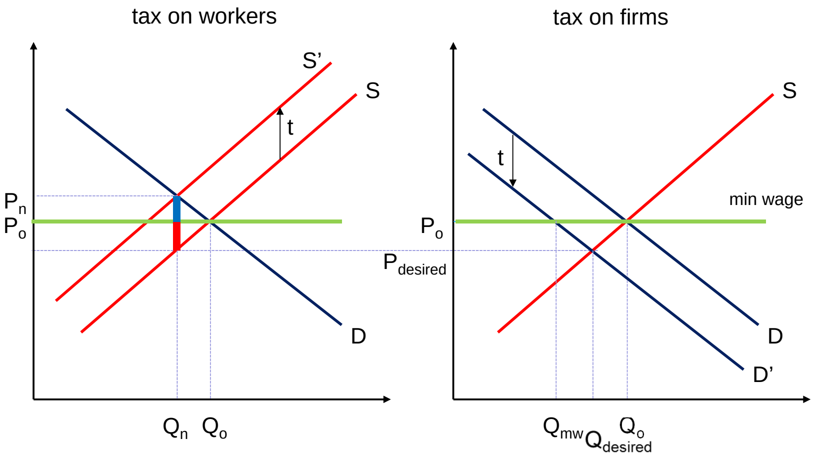
Tax with a Minimum Wage

What Quantity of Workers Can Firms Get?



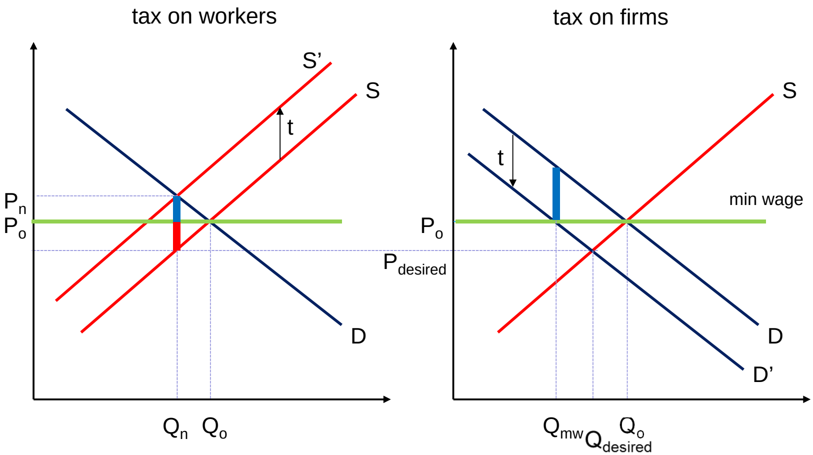
Tax with a Minimum Wage

Who Bears the Burden?



Tax with a Minimum Wage

Consumers of Labor (Firms) Bear the Burden



Summary of Taxes on Inputs

- Barriers to reaching the competitive market equilibrium can matter for tax incidence
- Other barriers include workplace norms, such as norm for not cutting nominal wages
- More likely to see these features in input, rather than output markets
- Therefore, the party on whom the tax is levied may matter more in input than output markets

General Equilibrium Tax Incidence

General Equilibrium Considerations

1. Illustrative example
2. Issues to consider
   - time period
   - scope
   - spillovers between product markets

Taxing Restaurants in Lexington, MA

- Suppose that the city of Lexington, MA passes a restaurant tax
- Suppose that demand is perfectly elastic – you can go to the next town to eat dinner
- Who bears the tax: restaurants or diners?

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- In the long run?

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- Restaurants use capital and labor – who bears the burden?
- Perhaps in the short run, labor is more elastic than capital, so capital bears the burden $\implies$ restaurant owner makes less money
- In the long run? restaurants leave, and landowners make less money
- In economics, land is the one absolutely fixed thing

General Equilibrium Issues: Time Period

Overarching rule for general equilibrium tax incidence is to follow the incidence until you get to a person.

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General Equilibrium Issues: Time Period

Overarching rule for general equilibrium tax incidence is to follow the incidence until you get to a person.

- Long and short-run elasticities should differ – examples?
- In general, the longer the period, the more elastic all factors are
- Except for land!

General Equilibrium Issues: Scope

- Scope of tax matters: elasticity of response to tax on restaurants in Lexington is different than tax on restaurants in Massachusetts
- Is the supply of workers for the state-wide tax more or less elastic?

General Equilibrium Issues: Scope

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- Is the supply of workers for the state-wide tax more or less elastic? less elastic
- Compare tax on soda to tax on sugar

General Equilibrium Issues: Cross-Product Market Effects

- Tax from one market could spill over in another – examples?
- Textbook uses restaurant meals and babysitters
- Think tax on internet and Netflix usage

Tax Incidence in the United States

Distributional Analysis of Taxes Depends on Assumptions About Incidence

Here's what two major non-partisan organizations assume

Tax Type	Incidence
Income	by households that pay them
Payroll	by workers (even the employer part)
Excise	shifted to prices, so in proportion to consumption
Corporate	shifted to owners of capital, so in proportion to capital income

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- Bradley and Feldman: Airline ticket pricing
  - Before 2012, airlines were not required to immediately quote a tax-inclusive price
  - Before the rule, airlines pass on almost full tax increase
  - After, airlines pass along only about $0.25 of each dollar of per-ticket tax

Today: Tax Incidence

- Tax incidence: who bears the burden of the tax
  1. Statutory incidence $\neq$ economic incidence
  2. Without impediments, side of the market on which the tax is levied does not impact incidence
  3. Less elastic factor bears the burden of the tax
- When there are impediments to reaching market equilibrium, which side of the market bears the tax matters
- General equilibrium tax incidence: the most inelastic factor bears the burden
- Rules of thumb for welfare analysis

Next Class

- Firms!
  - GLS Chapter 6 – but not 6.5 or 6.6
- And then the midterm