Lecture 6: Tax Incidence

October 3, 2017
Overview

Course Administration

Ripped From Headlines

Income and Substitution Effects, Revisited

Taxation Overview

Three Rules of Tax Incidence

Tax Incidence Extensions

General Equilibrium Tax Incidence

Empirical Incidence of Taxation in the US
Course Administration

1. Problem Sets
   - PS 6 posted
   - Returning PS 4
   - PS 3 and PS 4 answers posted

2. Midterm review
   - 10/15, 3 to 5 pm
   - Phillips 416
   - bring questions

3. Instructions for draft of elasticity memo

4. Anything else?
Ripped from the Headlines

Next Week

Afternoon

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<td>Lilia Ledezma</td>
<td>David Yarjah</td>
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<td>Jake Rettig</td>
<td>Emily Labandera</td>
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<td>Raphael Breit</td>
<td>Amanda Fins</td>
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Evening

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<td>Justin Pollard</td>
<td>Leslie Zelenko</td>
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<td>Ray Lazott</td>
<td>Cheryl Barnes</td>
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<td>Dale Abraham</td>
<td>Brian Wlcek</td>
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Earned Income Tax Credit
Tax Credits for Low-Income Workers

- when benefits increase
  - substitution effect → more work
  - income effect → more work
- when benefits plateau
  - no change in price of work → no substitution effect
  - income effect → more work
- when benefits decline
  - substitution effect → effective wage declines → less work
  - income effect → more work
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
Type of Taxation Shifted Dramatically in US

Sources of federal receipts

1960
- Income taxes: 44%
- Corporate taxes: 23%
- Excise taxes: 13%
- Other: 3%
- Social insurance contributions: 17%

2011
- Income taxes: 42%
- Social insurance contributions: 35%
- Excise taxes: 3%
- Other: 7%
- Corporate taxes: 13%
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 ≠ 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.
Types of Taxation

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

U.S. excise tax examples

- federal tax on bows, archery equipment and arrow shafts
- gasoline
- wine, varying by type, highest on “naturally sparkling”
Incidence ≡ 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
1. Statutory Incidence \( \neq \) Economic Incidence

What Happens When you Levy a Tax on the Producer?
1. Statutory Incidence ≠ Economic Incidence

What Are the New Equilibrium Price and Quantity?

price per gallon of gas
quantity of gas in billions of gallons

S'
S
D

P₀
Q₀

S' and S are the supply curves, D is the demand curve. A tax shifts the supply curve up, leading to a new equilibrium price (P₀) and quantity (Q₀).
1. Statutory Incidence $\neq$ Economic Incidence

How Much Extra is the Consumer Paying?

- price per gallon of gas
- quantity of gas in billions of gallons
- $S'$
- $S$
- $D$
- $P_n$
- $P_o$
- $Q_n$
- $Q_o$
1. Statutory Incidence $\neq$ Economic Incidence

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

![Graph showing supply and demand with tax effect]

- Price per gallon of gas
- Quantity of gas in billions of gallons
- Supply curve $S$ and $S'$
- Demand curve $D$
- Consumer's burden
- $P_n$, $P_o$
- $Q_n$, $Q_o$
1. **Statutory Incidence ≠ Economic Incidence**

Producer and Consumer Share the Burden of the Tax

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<th>price per gallon of gas</th>
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- **S** - Supply Curve
- **D** - Demand Curve
- **S'** - Supply Curve with Tax
- **P_o** - Original Price
- **P_n** - Price After Tax
- **Q_o** - Quantity Before Tax
- **Q_n** - Quantity After Tax

**consumer's burden**

**producer's burden**

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
  \[ = (\text{post-tax price} - \text{pre-tax price}) + \text{per-unit tax payment by consumer} \]
  \[ = \text{benefit/loss in price change to consumer} + \text{per-unit tax payment by consumer} \]
  \[ = (P_n - P_o) + \text{per-unit tax payments by consumers} \]
  \[ = P_n - P_o \]
Defining Tax Burdens, Tax on Producer

• consumer tax burden
  \[ = (\text{post-tax price} - \text{pre-tax price}) + \text{per-unit tax payment by consumer} \]
  \[ = \text{benefit/loss in price change to consumer} + \text{per-unit tax payment by consumer} \]
  \[ = (P_n - P_o) + \text{per-unit tax payments by consumers} \]
  \[ = P_n - P_o \]

• producer tax burden
  \[ = (\text{pre-tax price} - \text{post-tax price}) + \text{per-unit tax payment by producer} \]
  \[ = \text{per-unit tax payment by producer} + \text{benefit/loss in price change to producer} \]
  \[ = \text{per-unit tax payments by producers} - (P_n - P_o) \]
  \[ = \text{tax} - (P_n - P_o) \]
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 $2/\text{unit}$?
- 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 $Q = 2P - 2$
  • re-write in terms of $P$: $P = 1 + (1/2)Q$
• Note that $P_{at} = P_{bt} + 2$
• So we can write the after-tax supply curve as

$$P = 1 + (1/2)Q + 2$$
$$= 3 + (1/2)Q$$

• Note that you can re-write this as $Q = 2P - 2$
An Alternative Method to Finding New Supply

- Suppose that the supply curve before the tax is $Q_s = 2P - 2$.
- How does the supplier perceive a tax of $2/\text{unit}$?
An Alternative Method to Finding New Supply

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An Alternative Method to Finding New Supply

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  • \( P_{at} = P_{bt} + 2 \rightarrow P_{bt} = P_{at} - 2 \)
An Alternative Method to Finding New Supply

- Suppose that the supply curve before the tax is \( Q_s = 2P - 2 \).
- 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 supply curve and \( bt \) the before tax supply curve
- We’d like to know market supply as a function of the taxed price: \( Q_s^{\text{tax}} = f(P) \)

\[
\begin{align*}
Q_s^{\text{tax}} &= 2P_{bt} + 2 \\
Q_s^{\text{tax}} &= 2(P_{at} - 2) + 2 \\
Q_s^{\text{tax}} &= 2P_{at} - 4 + 2 = 2P_{at} - 2
\end{align*}
\]
Two Tax Price Terms

Gross Price

- price paid by or received by party not paying the tax to the government
- same as the market price
Two Tax Price Terms

Gross Price

- price paid by or received by party not paying the tax to the government
- same as the market price

After-tax Price

- price paid by or received by the party paying tax to the government
- lower by the amount of the tax if the producer pays the tax
- higher by the amount of the tax if the consumer pays the tax
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?

price per gallon of gas

quantity of gas in billions of gallons

\( S \)

\( D' \)

\( D \)

\( P_0 \)

\( Q_0 \)
Consumer Pays Tax
How Much Lower Price Does the Producer Suffer?
Consumer Pays Tax

How Much Does the Consumer Pay?

price per gallon of gas

quantity of gas in billions of gallons

producer’s burden

D

D’

Q_n Q_o

price per gallon of gas

quantity of gas in billions of gallons

producer's burden

P_o P_n

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P_o P_n
Consumer Pays Tax

Producer and Consumer Share the Burden of the Tax

price per gallon of gas

quantity of gas in billions of gallons

S
D
Q_o
Q_n
P_o
P_n
D'
t

consumer's burden
producer's burden

consumer's burden
producer's burden

price per gallon of gas

quantity of gas in billions of gallons

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t

consumer's burden
producer's burden
Consider Burdens

- When tax is levied on consumers
  - consumer burden
Consider Burdens

- When tax is levied on consumers
  - consumer burden $= t - (P_o - P_n)$
  - producer burden

- When tax is levied on producers
  - consumer burden $= P_n - P_o$
  - producer burden $= t - (P_n - P_o)$
  - total burden $= P_n - P_o + t - (P_n - P_o) = t$
Consider Burdens

- When tax is levied on consumers
  - consumer burden = $t - (P_o - P_n)$
  - producer burden = $P_o - P_n$
  - total burden

Note that in both cases, total burden is tax. The total price change faced by producers and consumers is equal regardless of the side of the market with the tax.
Consider Burdens

- When tax is levied on consumers
  - consumer burden = \( t - (P_o - P_n) \)
  - producer burden = \( P_o - P_n \)
  - total burden = \( t - (P_o - P_n) + P_o - P_n = t \)
Consider Burdens

- **When tax is levied on consumers**
  - consumer burden $= t - (P_o - P_n)$
  - producer burden $= P_o - P_n$
  - total burden $= t - (P_o - P_n) + P_o - P_n = t$

- **When tax is levied on producers**
  - consumer burden $= P_n - P_o$
  - producer burden $= t - (P_n - P_o)$
  - total burden $= P_n - P_o + t - (P_n - P_o) = t$
Consider Burdens

- **When tax is levied on consumers**
  - consumer burden = \( t - (P_o - P_n) \)
  - producer burden = \( P_o - P_n \)
  - total burden = \( t - (P_o - P_n) + P_o - P_n = t \)

- **When tax is levied on producers**
  - consumer burden = \( P_n - P_o \)
  - producer burden = \( t - (P_n - P_o) \)
  - total burden = \( P_n - P_o + t - (P_n - P_o) = t \)

- **Note that**
  - In both cases, total burden is tax
  - 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

price per gallon of gas
quantity of gas in billions of gallons

consumer's burden
producer's burden

consumer's burden
producer's burden

tax
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. Re-write one of the curves if the producer bears the statutory incidence of a $4/unit tax on the sale of rutabagas.

2. Who bears the economic incidence of this tax?
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?

- price per gallon of gas
- quantity of gas in billions of gallons
Inelastic Demand

What is the Original Equilibrium $P$ and $Q$?

price per gallon of gas

quantity of gas in billions of gallons
Inelastic Demand
How Does the Tax Shift Production?

price per gallon of gas

quantity of gas in billions of gallons

P_o
Q_o

D
S
Inelastic Demand

What Are the New Equilibrium $P$ and $Q$?

- $P_0$: price per gallon of gas
- $Q_0$: quantity of gas in billions of gallons
- $S$: supply curve before tax
- $S'$: supply curve after tax
- $D$: demand curve
- tax: increase in price due to tax
Inelastic Demand

What is the Consumer’s Burden?

price per gallon of gas

quantity of gas in billions of gallons

$P_n$

$P_o$

$Q_o = Q_n$

$S'$

$S$

tax

demand line

supply line

price before tax

price after tax
Inelastic Demand
Consumer Cannot Run Away From Tax

price per gallon of gas

consumer’s burden

Q_o = Q_n

quantity of gas in billions of gallons
Elastic Demand

What Does Elastic Demand Look Like?

price per gallon of gas

\( P_0 \)

quantity of gas in billions of gallons

\( S \)
Elastic Demand

How Does Tax on Producer Shift Supply?

price per gallon of gas

quantity of gas in billions of gallons

$P_0$

$Q_0$

S

D
Elastic Demand

What are the New Equilibrium $P$ and $Q$?

price per gallon of gas

quantity of gas in billions of gallons

$P_0$ $Q_0$
Elastic Demand
Producer Bears Entire Burden

price per gallon of gas

$P_n = P_o$

quantity of gas in billions of gallons

$Q_n$ $Q_o$

tax

$S'$ $S$ $D$
And the Same is True for Supply

(a) Tax on steel producers (inelastic supply)

(b) Tax on sidewalk vendors (elastic 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?

![Graph showing the consumer burden of taxes on workers and firms.](image)
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?

![Graph showing the comparison between tax on workers and tax on firms.]

- **Tax on Workers (Producers)**:
  - Workers supply labor, with supply curve $S$.
  - Tax rate $t$ shifts supply curve up to $S'$.
  - Price paid by firms increases from $P_o$ to $P_n$.
  - Quantity supplied decreases from $Q_o$ to $Q_n$.

- **Tax on Firms (Consumers)**:
  - Firms demand labor, with demand curve $D$.
  - Tax rate $t$ shifts demand curve down to $D'$.
  - Price paid by workers decreases from $P_o$ to $P_n$.
  - Quantity demanded increases from $Q_o$ to $Q_n$.

The diagram illustrates how taxes affect the market dynamics between workers and firms, with specific changes in prices and quantities due to tax imposition.
Tax on Workers (Producers) vs. Tax on Firms (Consumers)

Doesn’t Matter Who Pays the Tax

Diagram showing the effect of a tax on workers versus a tax on firms on the market equilibrium. The diagram illustrates that the tax impact on the market is the same, regardless of 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
What Are the New Equilibrium $P$ and $Q$?

tax on workers

tax on firms
Tax with a Minimum Wage
What is the Consumer (Labor Purchaser) Burden?

税对工人的影响

税对企业的影响

税对工人的影响

税对企业的影响
Tax with a Minimum Wage

What is the Producer (Worker Supplier) Burden?

tax on workers

tax on firms

min wage

$P_n$ $P_o$

$Q_n$ $Q_o$

$S'$ $S$

$D$

$P_o$

$Q_o$
Tax with a Minimum Wage

What if Firms Pay the Payroll Tax?

tax on workers

tax on firms
Tax with a Minimum Wage

New Equilibrium $P$ and $Q$?

tax on workers

tax on firms

tax on workers

tax on firms

$P_n$, $P_o$

$Q_n$, $Q_o$

$D$, $D'$

$S$, $S'$

min wage
Tax with a Minimum Wage

What Quantity of Workers Can Firms Get?

![Graph showing tax impact on workers and firms](https://via.placeholder.com/150)

- **Tax on Workers**
  - Supply curve shifts up by $t$.
  - Quantity demanded decreases from $Q_o$ to $Q_n$.
  - Price paid by firms increases from $P_o$ to $P_n$.

- **Tax on Firms**
  - Demand curve shifts down by $t$.
  - Quantity supplied decreases from $Q_o$ to $Q_{desired}$.
  - Price received by workers remains at $P_o$.

- **Minimum Wage**
  - Horizontal line at $P_o$.
  - Firms supply $Q_{desired}$ workers.
Tax with a Minimum Wage

Who Bears the Burden?

tax on workers

tax on firms

\[ \text{min wage} \]

\[ Q_{\text{desired}} \]

\[ Q_{\text{mw}} \]

\[ P_{\text{desired}} \]

\[ P_0 \]

\[ P_n \]

\[ Q_n \]

\[ Q_0 \]
Tax with a Minimum Wage
Consumers of Labor (Firms) Bear the Burden

tax on workers

tax on firms

tax on workers

D
S
Qo
Po
t
Qn
Pn
S'
tax on firms

D
S
Qo
Po
t
Pdesired
Qmw
min wage
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?
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? the restaurants
- And what happens to the quantity of restaurant meals consumed?
Taxing Restaurants in Lexington, MA

- Suppose that the city of Lexington, MA passes a restaurant tax
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But That’s Not the End

- A restaurant doesn’t pay taxes. In the end, people pay taxes.
- Restaurants use capital and labor – who bears the burden?
But That’s Not the End

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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?
But That’s Not the End

• A restaurant doesn’t pay taxes. In the end, people pay taxes.
• 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 \( \Rightarrow \) 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.
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?
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

- 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? 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

<table>
<thead>
<tr>
<th>Tax Type</th>
<th>Incidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Income</td>
<td>by households that pay them</td>
</tr>
<tr>
<td>Payroll</td>
<td>by workers (even the employer part)</td>
</tr>
<tr>
<td>Excise</td>
<td>shifted to prices, so in proportion to consumption</td>
</tr>
<tr>
<td>Corporate</td>
<td>shifted to owners of capital, so in proportion to capital income</td>
</tr>
</tbody>
</table>
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

- Midterm