Public Economics UC3M
Incidence of Taxation

Based on Raj Chetty and Gregory A. Bruich

Fall 2015

Introduction

- (Stiglitz 18, 482-497; AGZ 3.1 + 255-257;)
- Most of the slides here come from Raj Chetty. You might want to wacht his video: http://www.rajchetty.com/index.php/lecture-videos That is a graduate class, but I'm sure you can follow the first part of it.
- As an alternative to these slides you can study "Class Notes 3"

Definition(Raj Chetty)

- Tax incidence is the study of the effects of tax policies on prices and the distribution of utilities
- What happens to market prices when a tax is introduced or changed?
  - Increase tax on cigarettes by \$1 per pack
  - Introduction of Earned Income Tax Credit (EITC)
  - Food stamps program
- Effect on price $\longrightarrow$ distributional effects on smokers, profits of producers, shareholders, farmers, ...

Economic vs. Statutory Incidence(Raj Chetty)

- Equivalent when prices are constant but **not** in general
- Consider the following argument:
  - Government should tax capital income b/c it is concentrated at the high end of the income distribution
- Neglects general equilibrium price effects
  - Tax might be shifted onto workers
  - If capital taxes $\longrightarrow$ less savings and capital flight, then capital stock may decline, driving return to capital up and wages down
  - Some argue that capital taxes are paid by workers and therefore *increase* income inequality (Hassett and Mathur 2009)

Overview

- Tax incidence is an example of positive analysis
  - Typically the first step in policy evaluation
  - An input into thinking about policies that maximize social welfare
- Theory is informative about signs and comparative statics but is inconclusive about magnitudes
  - Incidence of cigarette tax: elasticity of demand w.r.t. price is crucial
  - Labor vs. capital taxation: mobility of labor, capital are critical

Overview

- 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)

Partial Equilibrium Incidence: Key Assumptions(Raj Chetty)

1. **Two good economy**
   - Only one relative price $\longrightarrow$ partial and general equilibrium are same
   - Can be viewed as an approx. of incidence in a multi-good model if
     - the market being taxed is "small"
     - there are no close substitutes/complements in the utility fn
2. **Tax revenue is not spent on the taxed good**
   - Tax revenue is used to buy untaxed good or thrown away
3. **Perfect competition among producers**
   - Relaxed in some studies of monopolistic or oligopolistic markets

Partial Equilibrium Model: Setup(Raj Chetty)

- Two goods: x and y
- Government levies an **excise** tax on good x
  - **Excise or specific tax**: levied on a quantity (e.g. gallon, pack, ton)
  - **Ad-valorem tax**: fraction of prices (e.g. sales tax)
- Let p denote the pretax price of x and $q = p + t$ denote the tax inclusive price of x
- Good y, the numeraire, is untaxed

Partial Equilibrium Model: Demand(Raj Chetty)

- Consumer has wealth Z and has utility $u(x, y)$
- Let $\varepsilon_D = \frac{\partial D}{\partial q} \frac{q}{D(q)} = \frac{\partial \log D}{\partial \log q}$ denote the price elasticity of demand
  - Elasticity: % change in quantity when price changes by 1%
  - Widely used concept because elasticities are unit free

Partial Equilibrium Model: Supply(Raj Chetty)

- Price-taking firms
- Use $c(S)$ units of the numeraire y to produce S units of x
- Cost of production is increasing and convex:

$$c'(S) > 0 \text{ and } c''(S) \geq 0$$

- Profit at pretax price p and level of supply S is $pS - c(S)$
- With perfect optimization, the supply function for good x is implicitly defined by the marginal condition $p = c'(S(p))$
- Let $\varepsilon_S = \frac{\partial S}{\partial p} \frac{p}{S(p)}$ denote the price elasticity of supply

Partial Equilibrium Model: Equilibrium(Raj Chetty)

- Equilibrium condition

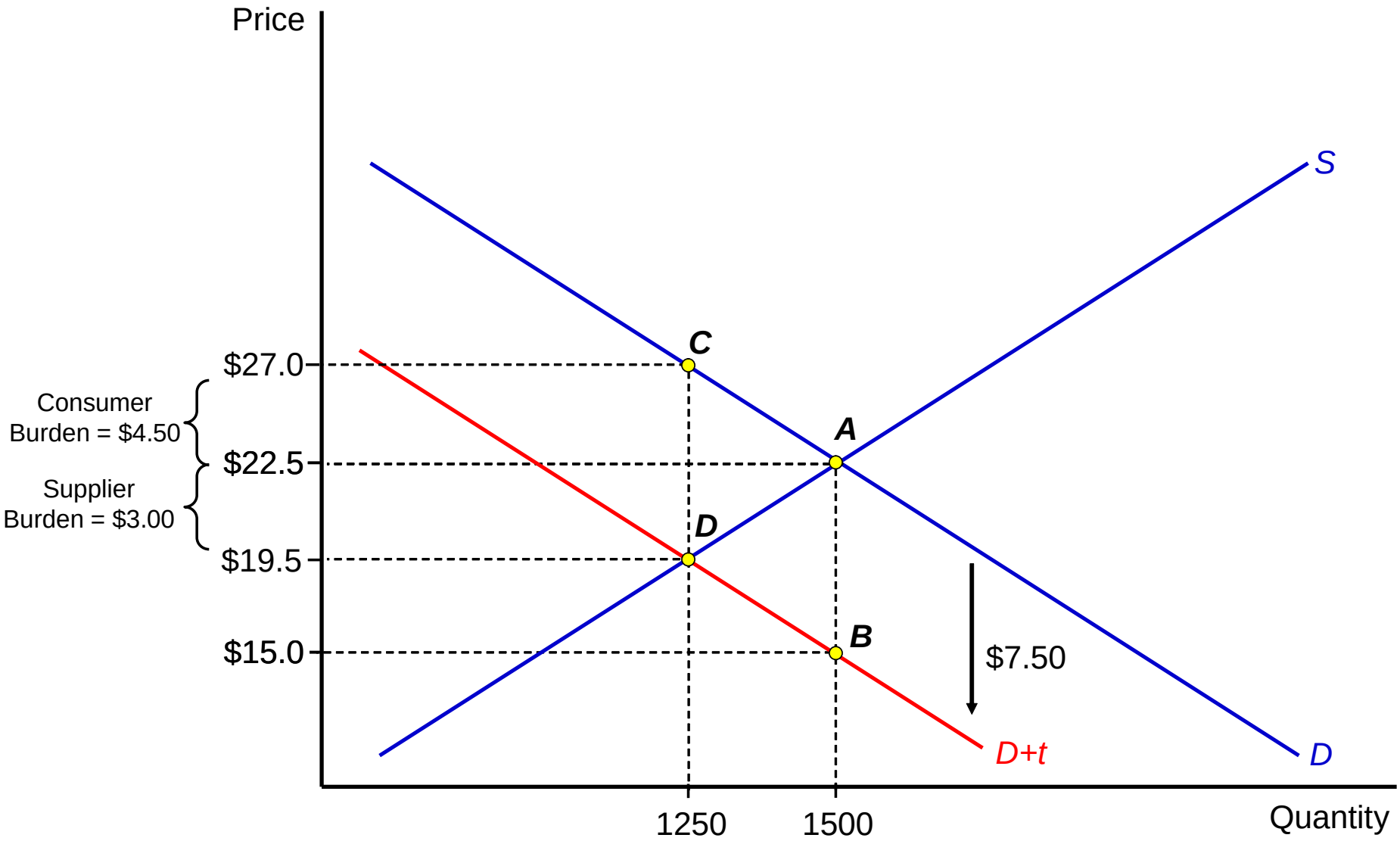
$$Q = S(p) = D(p + t)$$

  defines an equation $p(t)$

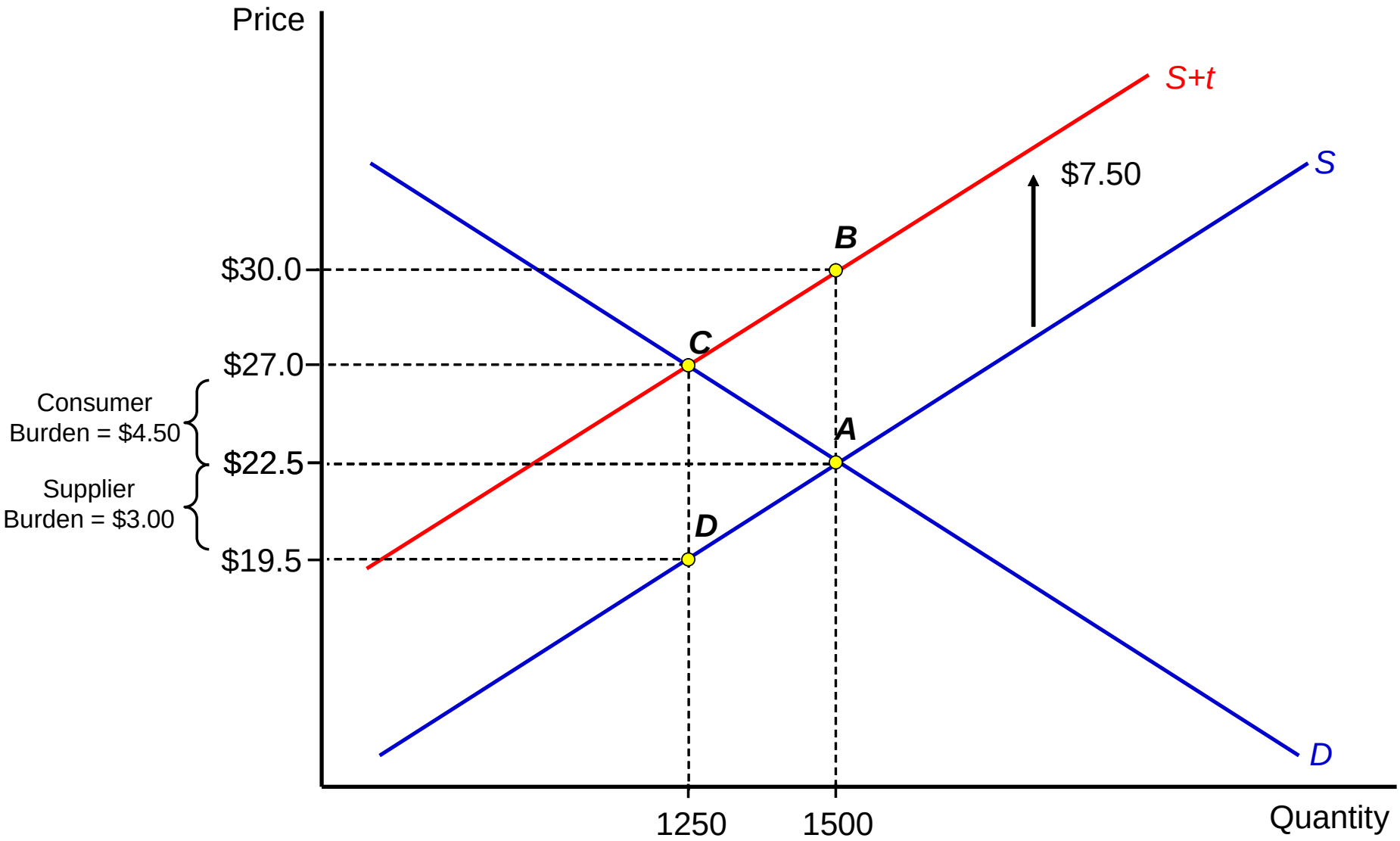
- Goal: characterize $\frac{dp}{dt}$, the effect of a tax increase on price

- First consider some graphical examples to build intuition, then analytically derive formula

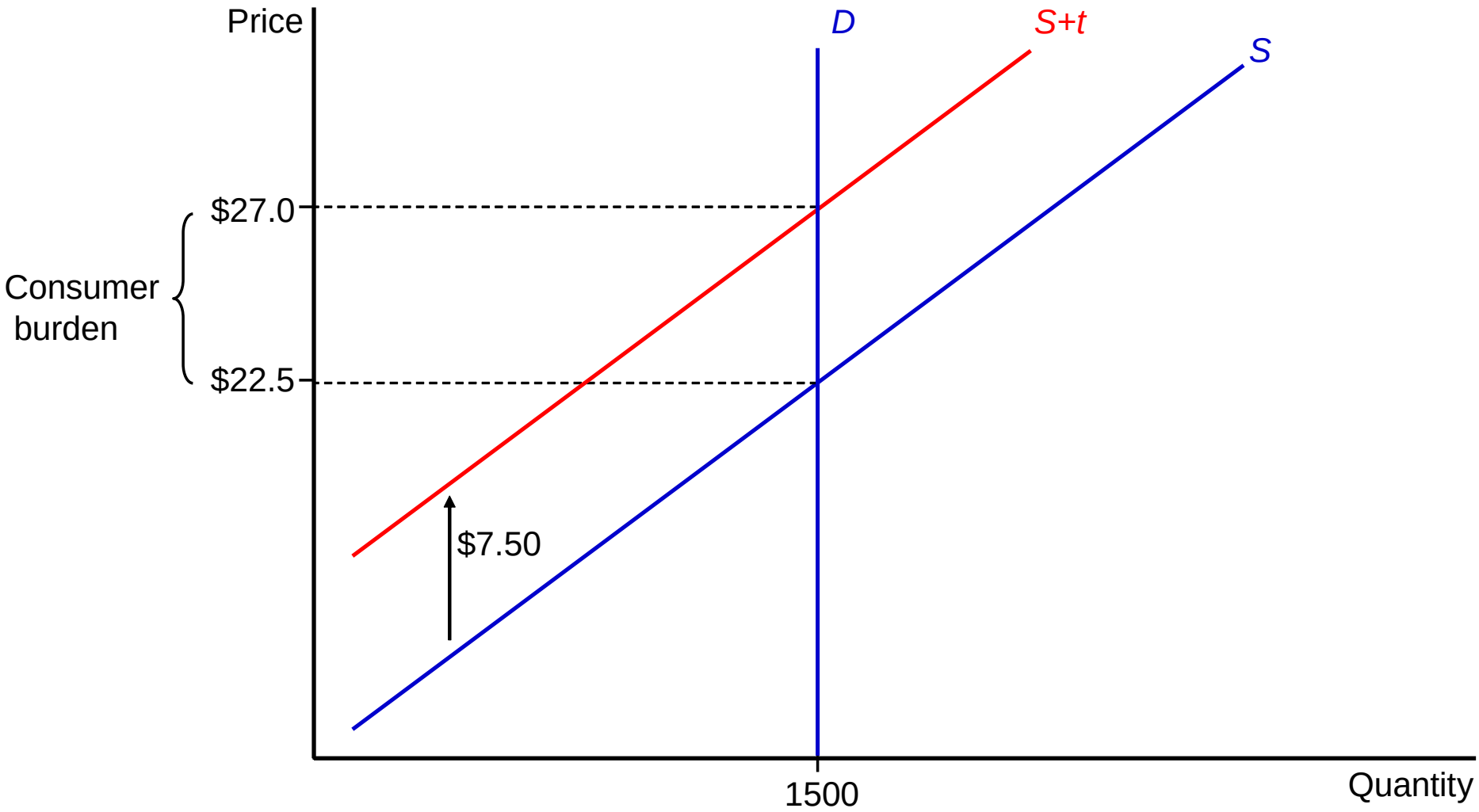
Tax Levied on Consumers



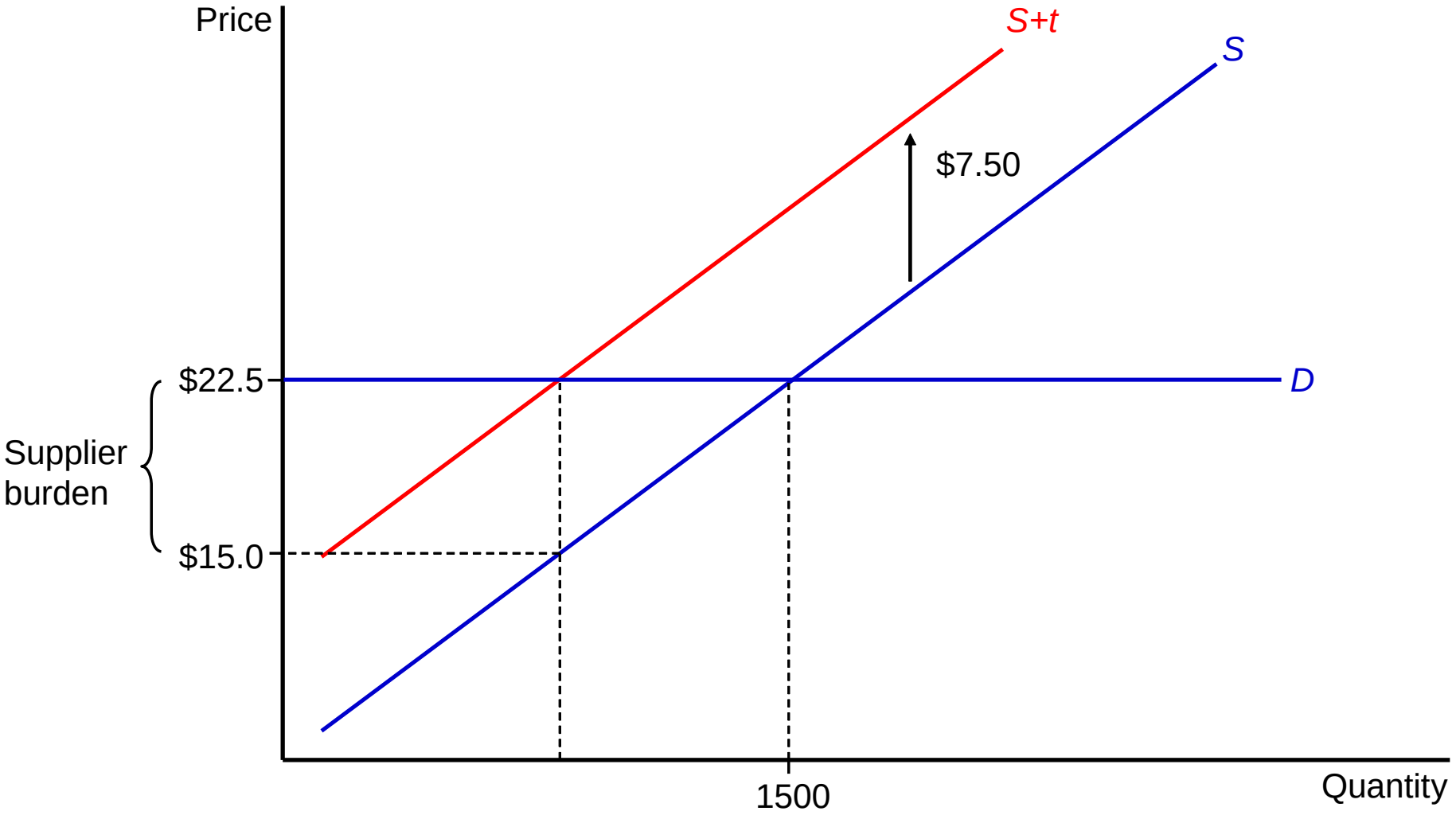
Tax Levied on Producers



Perfectly Inelastic Demand



Perfectly Elastic Demand



Formula for Tax Incidence(Raj Chetty)

- Implicitly differentiate equilibrium condition

$$D(p+t) = S(p)$$

to obtain:

$$\frac{dp}{dt} = \frac{\partial D}{\partial p} \frac{1}{(\frac{\partial S}{\partial p} - \frac{\partial D}{\partial p})}$$

$$\Rightarrow \frac{dp}{dt} = \frac{\varepsilon_D}{\varepsilon_S - \varepsilon_D}$$

- Incidence on consumers:

$$\frac{dq}{dt} = 1 + \frac{dp}{dt} = \frac{\varepsilon_S}{\varepsilon_S - \varepsilon_D}$$

Tax Incidence with Salience Effects(Raj Chetty)

- Central assumption of neoclassical model: taxes are equivalent to prices ($\frac{dx}{dt} = \frac{dx}{dp}$)
- In practice, are people fully aware of marginal tax rates?
- Chetty, Looney, and Kroft (2009) test this assumption and generalize theory to allow for salience effects
- **Part 1:** Test whether "salience" (visibility of tax-inclusive price) affects behavioral responses to commodity taxation
  - Does effect of a tax on demand depend on whether it is included in **posted** price?
- **Part 2:** Develop formulas for incidence and efficiency costs of taxation that permit salience effects and other optimization errors

Tax Incidence: Empirical Applications (optional)

1. [Evans, Ringel, and Stech 1999]: Cigarette excise taxes
2. [Hastings and Washington 2010]: Food stamps
3. [Rothstein 2010]: Earned Income Tax Credit

Evans, Ringel, and Stech (1999)

- Question: How do cigarette tax increases affect prices?
  - Do they take money from cigarette companies or smokers?
- Partial equilibrium is a plausible approximation for cigarettes, so use that framework here

Cigarette Taxation: Background

- Cigarettes taxed at both federal and state levels in U.S.
- Total revenue of about $35 billion per year, similar to estate taxation
- Federal tax increased from $0.39 to $1.01 per pack in 2009
- Variation among states: from 30 cents per pack in VA to $4.35 in NY in 2012
- Controversial commodity due to health and paternalism concerns

Evans, Ringel, and Stech (1999)

- Since 1975, more than 200 state tax changes $\longrightarrow$ natural experiments to investigate tax incidence
- Exploit these state-level changes in excise tax rates using simple diff-in-diff research designs
- Idea: Suppose federal govt. implements a tax change. Compare cigarette prices before and after the change

$$D = [P_{A1} - P_{A0}]$$

- Identification assumption: absent the tax change, there would have been no change in cigarette price

Difference-in-Difference

- But what if price fluctuates because of climatic conditions or trends in demand?

  $\rightarrow$First difference (and time series) estimate biased

- Can relax ID assumption using diff-in-diff

$$DD = [P_{A1} - P_{A0}] - [P_{B1} - P_{B0}]$$

- State A: experienced a tax change (treatment)
- State B: does not experience any tax change (control)
- Identifying assumption for DD: "parallel trends:" absent the policy change, $P_1 - P_0$ would have been the same for A and B

Evans, Ringel, and Stech: Demand Elasticity

- Demand model estimate implies that: $\varepsilon_D = -0.42$

  $\rightarrow$ 10% increase in price induces a 4.2% reduction in consumption

- How to compute price elasticity of demand when using variation arising from tax changes?

- Tax passed 1-1 onto consumers, so we can substitute $\Delta P = \Delta T$ here

- Then compute ε_D from $\hat{\beta} = (\Delta Q / Q) / \Delta T$ from regression coefficient of log demand on cigarette tax:

$$\varepsilon_D = \frac{P}{Q}\frac{\Delta Q}{\Delta T} = \hat{\beta} / P$$

with P (price) and Q (quantity) are sample means

Evans, Ringel, and Stech: Distributional Incidence

- Use individual data to see who smokes by education group and income level
- Spending per capita decreases with the income level
- Tax is regressive on an absolute level (not only that share of taxes relative to income goes down)
- Conclusion: Taxes levied on cigarette companies lead to poor paying more for same goods, with no impact on companies!

Cigarette Tax Incidence: Other Considerations

1. Lifetime vs. current incidence (Poterba 1989)
    - Finds cigarette, gasoline and alcohol taxation are less regressive (in statutory terms) from a lifetime perspective
    - High corr. between income and cons share in cross-section; weaker corr. with permanent income.
2. Behavioral models (Gruber and Koszegi 2004)
    - If agents have self control problems, incidence conc. on poor is beneficial to the extent that they smoke less
3. Intensive vs. extensive margin: Adda and Cornaglia (2006)
    - Use data on cotinine (biomarker) levels in lungs to measure inhalation
    - Higher taxes lead to fewer cigarettes smoked but no effect on cotinine in lungs, implying longer inhalation of each cigarette

Hastings and Washington 2010

- Question: How does food stamps subsidy affect grocery store pricing?
- Food stamps typically arrive at the same time for a large group of people, e.g. first of the month
- Use this variation to study:
  1. Whether demand changes at beginning of month (violating PIH)
  2. How much of the food stamp benefit is taken by firms by increased prices rather than consumers (intended recipients)

Hastings and Washington: Data

- Scanner data from several grocery stores in Nevada
- Data from stores in high-poverty areas ($>$15% food stamp recipients) and in low-poverty areas ($<$3%)
- Club card data on whether each individual used food stamps
- Data from other states where food stamps are staggered across month used as a control
- Research design: use variation across stores, individuals, and time of month to measure pricing responses

Hastings and Washington: Results

- Demand increases by 30% in 1st week, prices by about 3%
- Very compelling because of multiple dimensions of tests: cross-individual, cross-store, cross-category, and cross-state
- Interesting theoretical implication: subsidies in markets where low-income recipients are pooled with others have better distributional effects
    - May favor food stamps as a way to transfer money to low incomes relative to a subsidy such as the EITC

Rothstein 2010

- How does EITC affect wages?
- EITC payments subsidize work and transfer money to low income working individuals ($50 bil/year)
- This subsidy could be taken by employers by shifting wage
  - Ex: inelastic demand for low-skilled labor and elastic supply $\longrightarrow$ wage rate adjusts 1-1 with EITC
- Policy question: are we actually transferring money to low incomes through this program or are we just helping business owners?

Rothstein: Model

- Rothstein considers a model of the labor market with three types of agents

  1. Employers
  2. EITC-eligible workers
  3. EITC-ineligible workers

- Extends standard partial eq incidence model to allow for differentiated labor supply and different tax rates across demographic groups

- Heterogeneity both complicates the analysis and permits identification

- Identification strategy: compare wage changes across groups who were affected differently by expansions of EITC program from 1992-94

Rothstein: Results

- Basic DFL comparisons yield perverse result: groups that benefited from EITC and started working more had more wage growth
- Potential explanation: demand curve shifted differentially – higher demand for low skilled workers in 1990s.
- To deal with this, repeats same analysis for 1989-1992 (no EITC expansion) and takes differences
- Changes sign back to expected, but imprecisely estimated

Rothstein: Results

- Ultimately uses quantity estimates and incidence formula to back out predicted changes
  - Wage elasticity estimates: 0.7 for labor supply, -0.3 for labor demand
- Implications using formulas from model:
  - EITC-eligible workers gain \$0.70 per \$1 EITC expansion
  - Employers gain about \$0.70
  - EITC-ineligible low-skilled workers lose about \$0.40
- On net, achieve only \$0.30 of redistribution toward low income individuals for every \$1 of EITC

Rothstein: Caveats

1. Identification heavily complicated by recession, trends (SBTC); no clean control group
2. Data limitations: no panel data; problems in measurement – no annual income, cannot measure MTR
3. Short run vs. long run effects; important due to evidence of nominal wage rigidities.
4. Pure extensive-margin analysis. Intensive margin would go the other way b/c EITC is not a marginal subsidy to wage for a very large fraction of the population.