External Costs of Poor Health

ECON40565
Fall 2007

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Introduction

- Much of morbidity and mortality is caused by behavior
  - 50% of all deaths (tobacco, alcohol, driving, etc)
- Sometimes these behaviors only impact the individual making the decision
- Other times, the behavior can impact others
  - Financially
  - Health wise

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Examples

- Obvious examples
  - Infectious diseases
  - Drunk driving
  - Second hand smoke
- Some not so obvious
  - Obesity/tobacco use increases costs of health insurance premiums for others
  - Your immunization reduces the chance that others will be infected

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This section

- Examine in detail general topic of externalities
  - Define them
  - Why they are 'bad' from an economic sense
  - How can we measure the size of welfare loss
- Show how taxes can be used to limit the social costs of an externality

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This section

- Extended example: Do smokers and drinkers pay their way?
  - Alcohol and cigarette consumption generates externalities
  - They are also taxed at the local, state and federal level
  - Sum up the external costs of smoking/drinking
  - Compare to the revenues raised by taxes
  - Surprising results
- Excellent example of how economists look at problems

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Before we start

- Basic review of the dead weight loss from externalities
- How taxes can internalize the costs of externalities

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Demand curve

- $Q_d = f(P)$
- Slopes down due to declining marginal utility
- Height of demand represents the value placed on the last product consumed
- We will always use inverse demand curves – easier to graph
- $P = f^{-1}(Q)$

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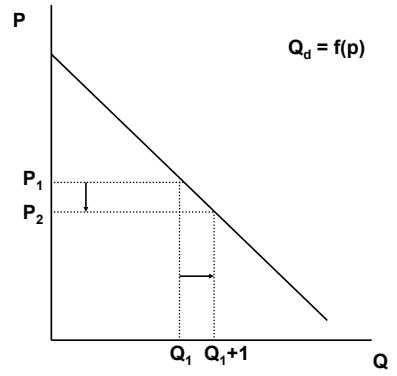

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Consumer's Surplus

- Consumers continue to purchase so long as the value of the next unit is greater than price
- But all units priced the same
- Consumer's value the last unit at P_1
- For all units consumed up to Q_1, the value to the consumer exceeded price
- Area A represents consumer's surplus

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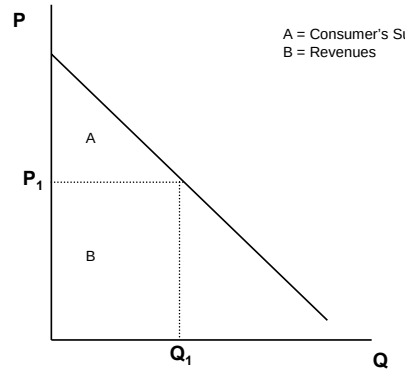

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Example

- Inverse demand curve
- P = 100 – 4Q
  - When Q=0, P=100
  - When P=0, Q=25
- Suppose P=40, Q=15
- CS = (1/2)Height*base
- REV=P*Q

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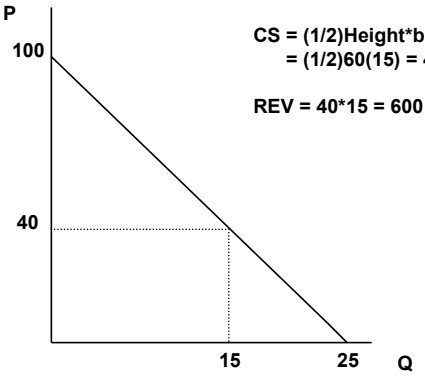

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Producer's Surplus

- In competitive market, market supply curve is the horizontal summation of firm's marginal cost curve
- Height represents the amount firms must receive to sell the last unit
- Since this is the marginal cost curve, it also represents what it costs society to produce the last unit
- Difference between price received and the marginal cost of production is Producer's Surplus

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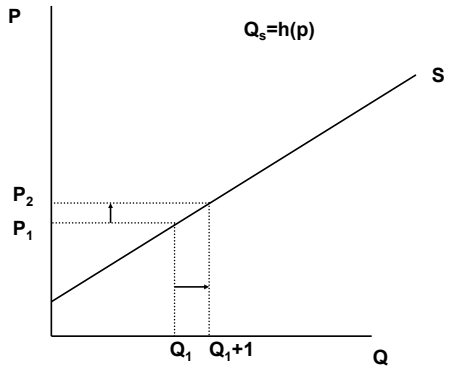

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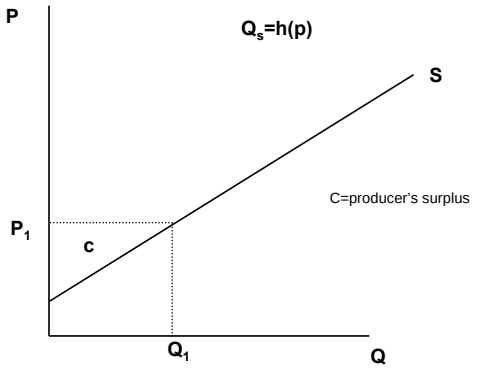

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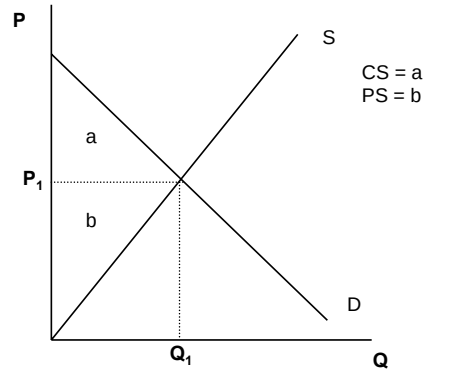

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- **Demand:** P=12 – 0.5Q
- **Supply:** P=2 + 0.3Q

- **Graphing**
  - Demand
    - Q=0, P=12
    - P=0, q=24
  - Supply
    - Q=0, P=2

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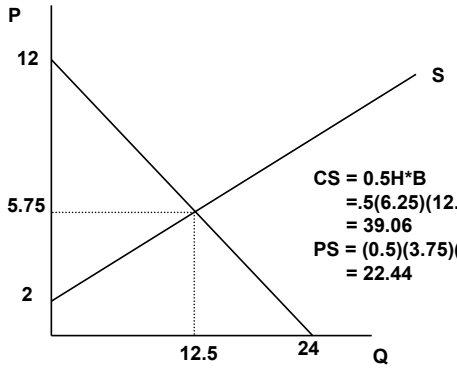

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Externalities

- Actions of one party make another worse/better off, yet the first party does not bear all the costs/benefits benefits
- The full costs/benefits of an economic transaction are not fully captured in the transacted prices
  - What person pays in price
  - What a firm pays in costs

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Negative Externalities

- Pollution from a production process
- Noise from a nightclub near a residential neighborhood
- The person next to you during an exam has a cold
- Second hand smoke

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Positive Externalities

- You get a flu shot. This reduces the probability others will get the flu. They benefit, you paid the costs
- Your beautiful garden raises the value of your neighbor's house
- Lojak:
  - Transmitted on car that can be used to locate a stolen vehicle
  - Reduced auto thefts in areas where it was introduced
  - Only a small fraction had Lojak. As a result, non-Lojak users benefited

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Excess production and negative externalities

- Suppose production of the good generates externalities that are not reflected in costs of inputs (e.g., pollution)
- The true cost of producing the good is above the costs firms pay to produce
- Since firms are not paying all the costs of production, the 'wedge' between private costs and social costs encourages overproduction

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Production externalities

- Perfectly competitive market. Supply Curve = marginal cost curve (MC)
- Not all costs of production are borne by the firm, e.g., pollution
- PMC = private marginal cost, the firm's costs, therefore, the industry supply
- SMC = social marginal cost
- SMC > PMC for all Q

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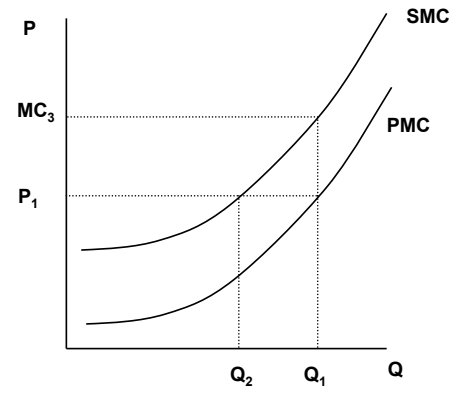

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- At market price P_1, firms are willing to sell Q_1 units. However, from a social standpoint, if all costs were paid by the firm, they would only be willing to supply Q_2
- The firm overproduces the good since they do not pay all the costs of production
- At Q_1, the firm receives P_1 but it costs society MC_3 to produce

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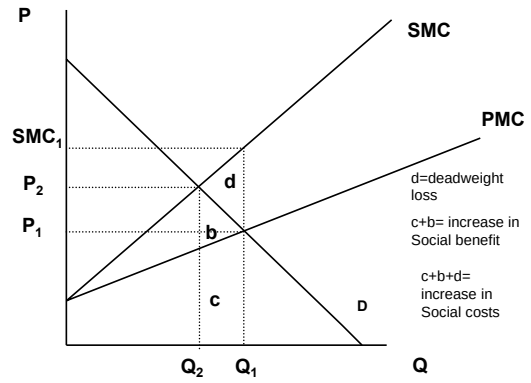

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- Market output (P_1, Q_1)
- At Q_1, $SMC_1 > P_1$
- Costing society more to produce than is transacted in the market
- Social optimum (P_2, Q_2)

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Social Costs of Overproduction

- Notice that as one moves from Q_2 to Q_1
- Society is spending an extra d+b+c on additional resources
- Consumers are however enjoying b + c in additional welfare
- The difference is area d, the deadweight loss of overproduction
- If there ever is a 'wedge' between what it costs to produce a good and what people are paying for it, there will be a deadweight loss

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What about consumption externalities?

- Standard downward sloping demand for a good
- Consumption of the good however has health/financial costs to others (e.g., second hand smoke or drunk driving)
- Private Marginal Benefit > Social Marginal Benefit

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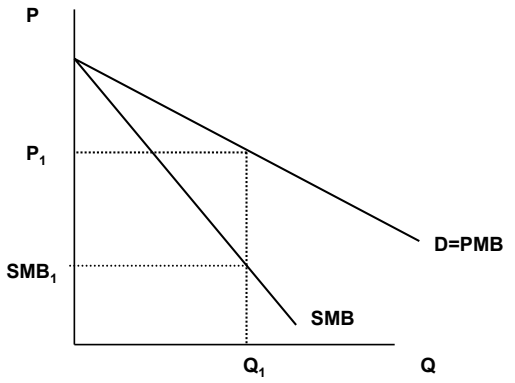

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- At Q_1, people value the last unit at P_1
- However, not all costs of the good are paid by the consumers
- The SMB is SMB_1 which is lower than price
- If people had to pay all the costs of the good (forget how they will do it for now), they would consume a lot less
- Therefore, there is over-consumption of the good

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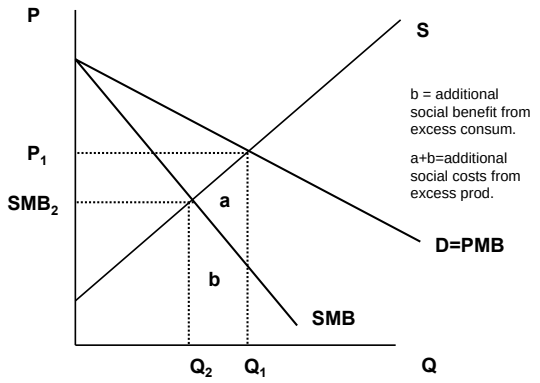

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- D=S at (P_1,Q_1)
- At this point
- Costs society and extra a+b to produce
- Society only receives an extra area b in benefits
- Difference (area a) is the deadweight loss of over production
- Again notice the wedge between value of marginal good and the price of the product
  - The marginal cost of producing the last unit is P_1.
  - The SMB is however only SMB_2

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Internalize the Externality

- Per unit tax on output – Pigouvian taxes
- "Excise tax"
- For every unit sold, charge consumers $t in a tax
- The excise tax will shift down the demand curve by an amount equal to the tax
- Remember, the Y (price) axis is the price transacted between buyers and sellers, does not reflect true cost

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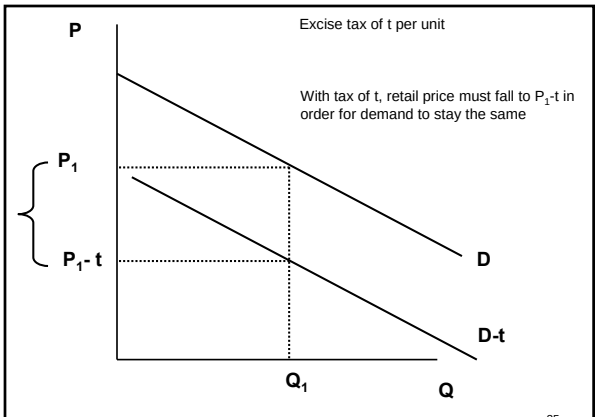

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- Vertical axis, amount transacted between buyers and sellers
- Without excise tax, at price P_1, people willing to consume Q_1
- With a tax of $t/unit, price paid to sellers would have to fall to P-t in order to demand Q_1
  - Pay P_1-t to firm
  - Pay t to government
  - Pay P_1-t +t = P_1 in total

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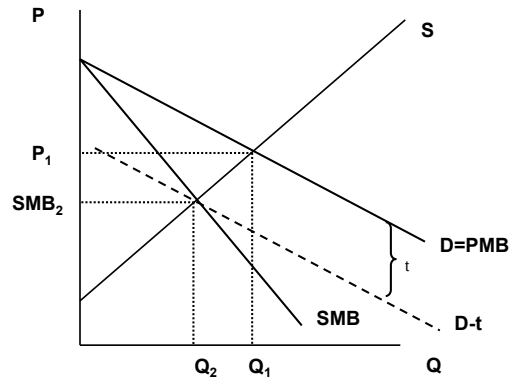

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Example

- Inverse demand: P=PMB=20 – Q
- Inverse SMB: SMB = 20 – 2Q
- Inverse Supply: P= 2 + Q
- Market outcome
  - Supply = demand
  - 20 – Q = 2 + Q
  - Q = 9
  - P = 2+Q = 11

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- Social optimum
  - Supply = Social Marginal Benefit
  - 2 + Q = 20 – 2Q
  - Q=6
  - P = 2+Q = 8
- What tax should be charged to obtain the social optimum?
- Want output to be Q=6.

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- Must choose a tax rate that reduces demand to 6
- People will demand Q=6 if P_d=14
  - PMB = 20 – Q, so when P=14, Q=6
- Suppliers will supply 6 if P_s=8
- P_d is inverse demand
- P_s is inverse supply
- With a rax, demand falls to P_d-t and we equate P_d-t=P_s, so t=P_d-P_s
- Therefore, t=Pd-Ps=14-8 = 6

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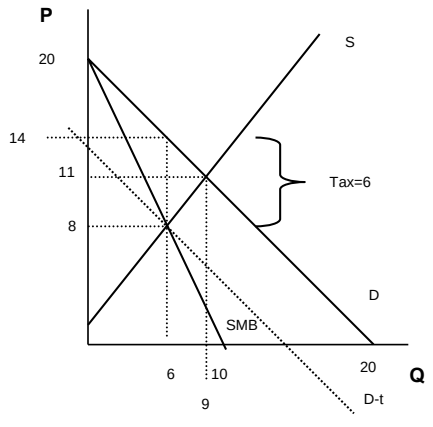

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Can show a per unit tax on suppliers can also solve externality problem

- Per unit tax will shift up supply curve by an amount t
- Verticle axis is amount transacted between buyers/sellers
- Without tax, at price P_1 producers willing to supply Q_1.
- When tax is imposed, suppliers receive a price, then pay t back to the government
- In order fir supply to stay at Q_1 with a tax, their price must rise to P_1+ t

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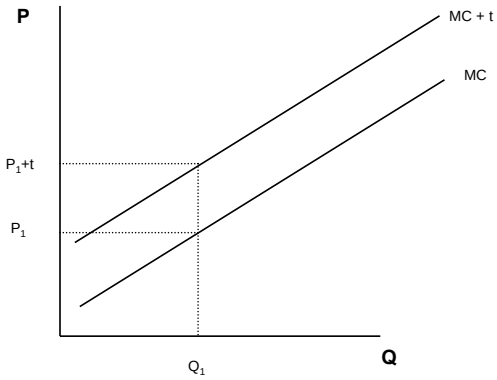

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- At P_1, firms were willing to supply Q_1
- With an excise tax, in order for firms to supply Q_1, the price must increase to P_1+t
  - Firm receives P_1+t
  - Pay the government t in taxes
  - Net P_1
- Therefore, an excise tax will shift the supply curve up by the amount of the tax

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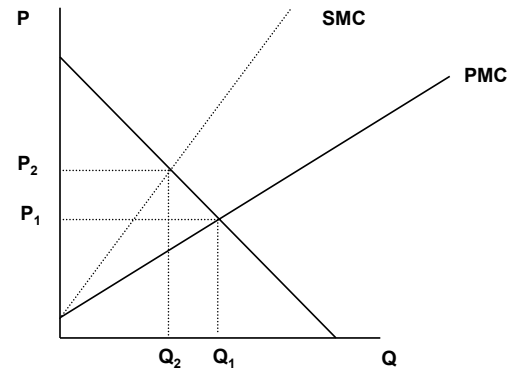

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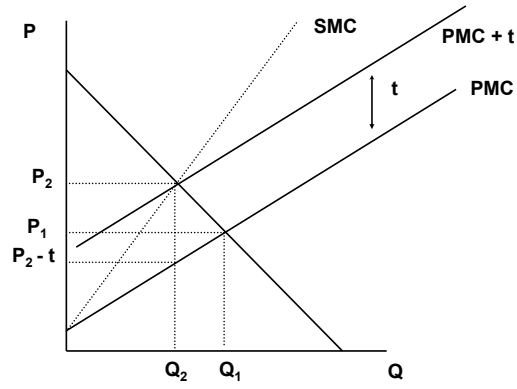

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Example

- Demand: $P_d = 20 - 2Q$
- PMC $P_s = 2 + Q$
- SMC $P_{smc} = 2 + 2Q$

- Market output: $P_s = P_d$
- 20 – 2Q = 2 + Q
- Q = 6, P=8

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- Social Optimum: $P_d = P_{sc}$
- 20 – 2Q = 2 + 2Q
- Q=4.5, P=11

- At the Market output, Q=6, so SMC = 14
- DWL = area d
- D = (1/2)Height*base
  = (1/2)(6-4.5)(14-8) = 4.5

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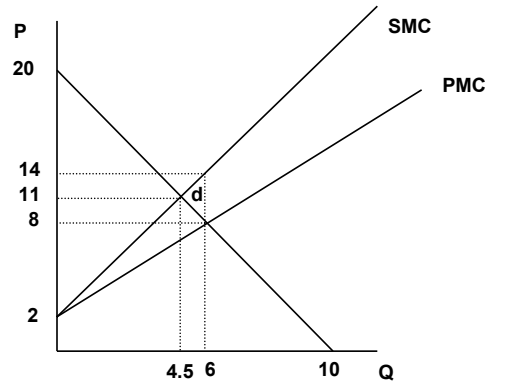

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Example

- Demand: $P_d = 30 – .3Q$
- PMC: $P_s = 2 + 0.1Q$
- SMC: $SMC = 2 + .2Q$

- Social optimum
  - $P_d = SMC$
  - $30 - .3Q = 2 + .2Q$
  - $28 = .5Q$
  - $Q= 56, P= 13.2$

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- Market equilibrium
  - $P_d=P_s$
  - $30 - .3Q = 2 + .1Q$
  - $28 = 0.4Q$
  - $Q = 70, P = 9$

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- What is the optimal tax?
  - Want Q = 56, the social optimal
  - People will demand 56 when their price is 13.2
  - What price will encourage firms to supply 56?
- Firms will receive P+t, but they have to give t back to the government.
  - $P = 2 + .1Q = 2 + .1(56) = 7.6$
  - When firms receive 7.6, they will supply 56.
  - Therefore 13.2 – 7.6 = 5.6 (tax)

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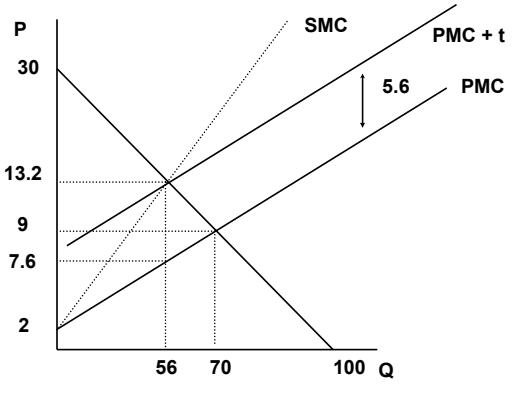

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Excises taxes on poor health

- Alcohol and cigarettes are taxed at the federal, state and local level
- Some states sell liquor rather than tax it (VA, PA, etc.)
- Most of these taxes are excise taxes -- the tax is per unit
  - Rates differ by type of alcohol, alcohol content
  - Nearly all cigarettes taxed the same

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Current excise tax rates

- http://www.taxfoundation.org/publications/show/245.html
- Cigarettes
  - Low: KY ($0.30/pack), VA ($0.30), SC($0.07)
  - High: RI ($2.46), NJ ($2.58)
  - Average of $1.07 across states
- Beer
  - Low (WY, $0.02/gallon)
  - High (SC, $0.77/gallon)

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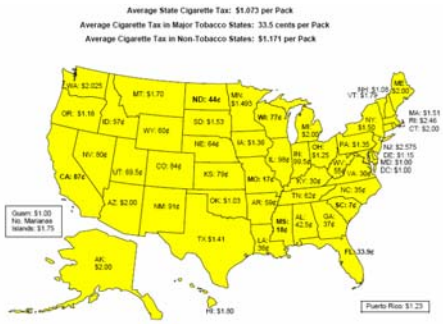

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Federal taxes

- Cigarettes, $0.39/pack
- Wine
  - $0.21/750ml bottle for 14% alcohol or less
  - $0.31/750ml bottle for 14 – 21% alcohol
- Beer, $0.02 a can
- Liquor, $13.50 per 100 proof gallon (50% alcohol), or, $2.14/750 ml bottle of 80 proof liquor
- Total taxes on cigarettes are such that in NYC, you spend more in taxes buying one case of cigarettes than if you buy 33 cases of wine.

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Do taxes reduce consumption?

- Law of demand
  - Fundamental result of micro economic theory
  - Consumption should fall as prices rise
  - Generated from a theoretical model of consumer choice
- Thought by economists to be fairly universal in application
- Medical/psychological view – certain goods not subject to these laws

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- Starting in 1970s, several authors began to examine link between cigarette prices and consumption
- Simple research design
  - Prices typically changed due to state/federal tax hikes
  - States with changes are 'treatment'
  - States without changes are control

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Difference in Difference

	Before Change	After Change	Difference
Group 1 (Treat)	Y_{t1}	Y_{t2}	$\Delta Y_t = Y_{t2}-Y_{t1}$
Group 2 (Control)	Y_{c1}	Y_{c2}	$\Delta Y_c = Y_{c2}-Y_{c1}$
Difference			$\Delta\Delta Y$ $\Delta Y_t - \Delta Y_c$

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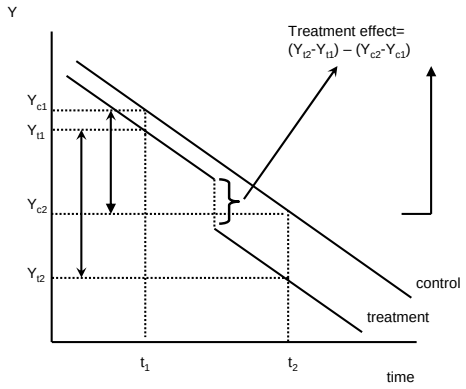

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Key Assumption

- **Control group identifies the time path of outcomes that would have happened in the absence of the treatment**
- **In this example, Y falls by Y_{c2}-Y_{c1} even without the intervention**
- **Note that underlying 'levels' of outcomes are not important (return to this in the regression equation)**

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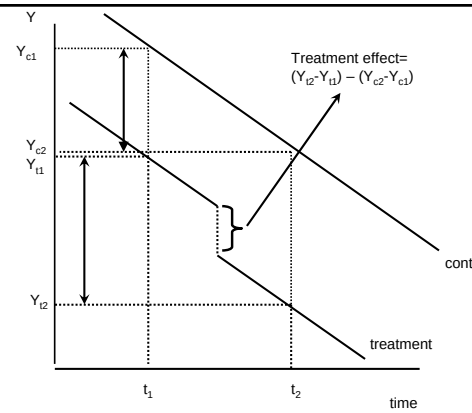

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- **In contrast, what is key is that the time trends in the absence of the intervention are the same in both groups**
- **If the intervention occurs in an area with a different trend, will under/over state the treatment effect**
- **In this example, suppose intervention occurs in area with faster falling Y**

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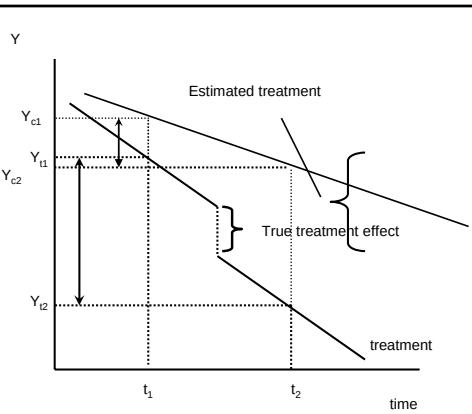

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- **Near universal agreement in results**
  - **10% increase in price reduces demand by 4%**
  - **Change in smoking evenly split between**
    - **Reductions in number of smokers**
    - **Reductions in cigs/day among remaining smokers**
- **Results have been replicated**
  - **in other countries/time periods, variety of statistical models, subgroups**
  - **For other addictive goods: alcohol, cocaine, marijuana, heroin, gambling**

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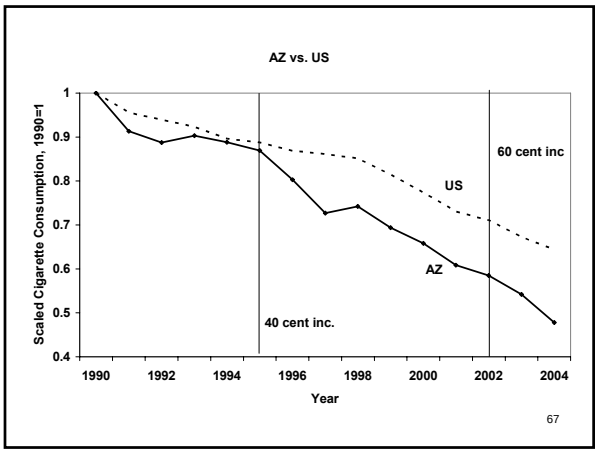

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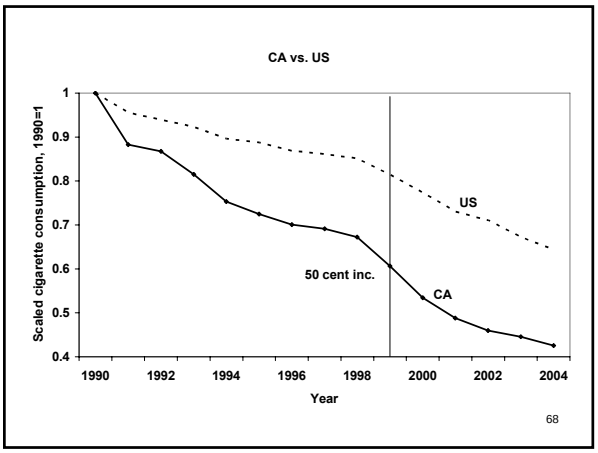

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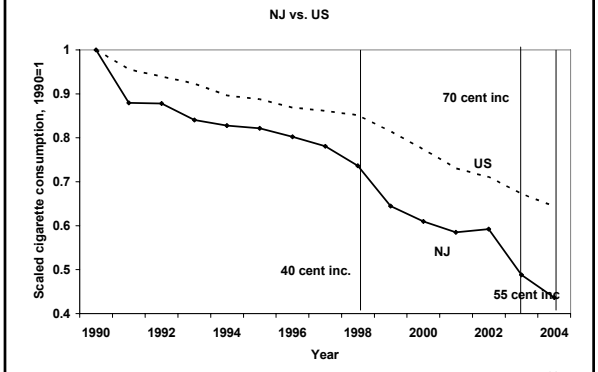

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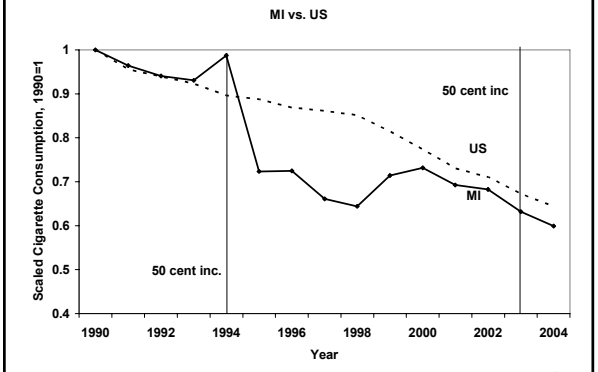

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Taxes now an integral part of antismoking campaigns

- **Key component of 'Master Settlement'**
- **Surgeon General's report**
  - ***"raising tobacco excise taxes is widely regarded as one of the most effective tobacco prevention and control strategies."***
- **Tax hikes are now designed to reduce smoking**

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- **By the end of 1996**
  - **9 states with cigarette excise taxes of $0.50**
  - **only 3 states with taxes in excess of $0.75/pack.**
- **By the end of 2002**
  - **24 states had taxes of $0.50 or more**
  - **13 states having a tax of a dollar per pack or more.**
- **Today**
  - **8 states with taxes >= $2/pack**
  - **25 states with taxes >= $1/pack**
  - **40 states with taxes>=$0.5/pack**

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External costs of poor health

- Manning et al. paper
- Accounting exericise
  - What are the external costs of alcohol, tobacco, sedentary lifestyle
  - Will focus on the 1st two in class
- Consider three sets of costs
  - Direct costs
    - Lives lost, fires, criminal justice
  - Collectively financed programs
    - Sick/medical leave, all types of insurance, retirement, federal transfer programs
  - Taxes on earnings

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Direct costs

- Lives lost due to poor health
  - Drunk driving deaths
  - Fires from smoking
  - Does not include
    - Death of the person
    - Any other family member (why is this? Is this a good assumption?)
- Criminal justice costs

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Collectively financed programs

- Health/life insurance
  - Costs of a smoker are paid collectively by those enrolled in an insurance program
  - Externalities can be reduced if premiums are correlated with smoking
- Gov't transfer programs tricky
  - Smoking/drinking increases current costs in Medicare/Medicaid
  - May decrease costs in the future

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Taxes on Earnings

- Smokers and heavy drinkers
  - Are less productive during working years (do not know whether this is causal)
  - If die prematurely, pay less in state/local income taxes

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What is NOT an external cost

- The smoker/drinkers diminished health or the health of their family members
- The lost earnings of these activities
- Why?

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Special case of Federal Programs

- Expenditures are correlated with longevity
  - Social security, Medicare/Medicaid costs increase for older people
- Because smoking kills people early
  - Prevents people from getting to the age when medical costs are very high
  - Reduces payment of Social Security benefits

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- From the perspective of the other taxpayers, these are positive externalities
- Smokers pay $ to Federal and states
- They do not take as much out (SS, Medicare/caid) because they die early

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External costs of smoking/drinking

	Cigarettes (per pack)	Heavy drinking (per ounce)
Collectively financed	$0.05	$0.23
Direct costs	$0.02	$0.93
Taxes on earnings	$0.09	$0.06
Total	$0.16	$1.19

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External costs of smoking/drinking

	Cigarettes (per pack)	Heavy drinking (per ounce)
External costs	$0.16	$1.19
Total taxes	$0.37	$0.20

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- Dollars values are in real 1986 dollars
- Between 1986 and now, prices have increased by about 75%
- If assume all deaths due to fires and passive smoke are external costs
  - Smoking cost rises to about $0.38/pack
- Results
  - Smokers pay their way
  - Drinkers do not

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Why the difference between alcohol and cigs?

- Most of the external costs of alcohol are monetized value of a statistical life
  - Value of life is valued at $5 million
  - Drunk drivers kill 10,000 people/year (other than themselves)
  - External costs of $50 billion

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Value of a statistical life

- People trade off $ for job characteristics
  - Jobs with nice characteristics paid less
  - Jobs with unattractive characteristics paid more
  - Hold ALL ELSE CONSTANT
- One characteristic is job risk
- Workers in higher risk jobs get paid more
- Can use the willingness to accept risk to calculate a 'statistical value of life'

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- Among blue collar workers, there is a 1 in 10,000 chance of dying on the job during the year.
- People in jobs with twice the average risk are estimated to make $500 more than identical people in average risk jobs.
- For every additional 10,000 workers in high-risk jobs, they will receive and extra $500 x 10,000 = $5 million in income

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- But among these additional workers, on average, 1 will die.
- VSL=value of a statistical life
- VSL = additional income people are willing to take for additional risk/expected additional deaths

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- Example: Suppose that a group of workers requires an additional $350 to accept an additional risk of death of 0.000152
- Just divide $350/0.000152 = $2.3 million
- Suppose there are an addition 50000 workers
  - Take home an additional 50000*350 = $17.5 million
  - But an additional 50000*0.000152 = 7.6 will die
  - 17.5/7.6=$2.3 million

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Drunk Driving Facts

- 17,000 MV deaths due to drunk drivers in 2003
  - down from 26K in 1981
  - 40% of all MV deaths in 2003
  - The drunk drivers themselves are 2/3rds of the alcohol-related MV fatalities, so you only count the 1/3 left over
- External costs of alcohol are now much lower -- probably too high by 34%

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Viscusi (1995) Costs of smoking

- External insurance costs per pack (1993$)
- Medical care $0.388
- Sick leave $0.016
- Group life insuance $0.072
- Nursing home care -$0.062
- Retirement pensions -$0.286
- Fires $0.092
- Total $0.238

- Taxes paid $0.53/pack

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Tax facts for 2006

- 18.6 billion packs
- At federal/state/local level, taxes generate $22 billion in revenue
- Average tax per pack is $1.18/pack
- Can argue this vastly understate actual taxes on cigarettes
- In settlement of state Medicaid, tobacco companies agreed to
  - Pay $206billion over 25 years
  - Paid for by raising price of cigarettes by 45 cents/pack

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What is not included in these numbers?

-
-

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What are some other justifications for higher cigarette taxes

- Recall the market graph. The problem w/ external costs is that people consume above a socially optimal level
- Can be other reasons why people 'over consumer' smoking
- Maybe people do not understand the health risks. If they did, they would not smoke

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Viscusi

- Survey, "of 100 smokers, how many will get lung cancer because they smoke?"
- Survey responses
  - Smokers
  - Non smokers
- The true risk level is
  -
- People over state the risk of smoking

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Do smokers underestimate the addictiveness of smoking?

- 82% of smokers say the would like to quit
  - About 50% of ever smokers eventually quit
  - What does this measure?
- Survey of HS smokers
  - 56% say they will NOT be smoking in 5 years
  - Only 31% actually quit
  - Among pack a day smokers
    - 72% who say they will quit in 5 yrs are still smoking
    - 74% who say they will not quit in 5yrs are still smoking

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