The theory of taxation/2 (ch. 19 Stiglitz, ch. 20 Gruber, ch.14 Rosen))

- Taxation and economic efficiency

Taxation and economic efficiency

- Most taxes introduce **deadweight losses because they alter relative prices and the allocation of resources** (example: the window tax in 17° century Britain induced the construction of windowless houses!; or tax on finished houses in Cyprus…).

- Only **Lump sum taxes are non distortionary** because they do not depend on alterable characteristics such as wealth or income or individuals/firms behaviour. *An example of non distortionary tax is a temporary retroactive tax on last year income.* But it works only once, otherwise it may affect expectations and becomes distortionary. Lump sum taxes are thus very difficult to implement in practice and often have negative equity effects. **They represent a benchmark to analyse the efficiency effects of taxation**.

- Also **corrective taxes** are considered efficient because they are levied to correct market failures, such as negative externalities (pollution taxes, carbon taxes, taxes on cigarettes,…) and rise tax revenues (and thus reduce the reliance on other taxes),improving economic efficiency (*double dividend*).

Examples of Tax Avoidance (Gruber)

The inefficiency of any tax depends on the extent to which consumers and producers change their behavior to avoid the tax.

EXAMPLES OF TAX AVOIDANCE

- A British boat designer lived in a home he constructed from a floating bridge. He sailed up and down the river in order to avoid tax collectors for property tax. He collected so many different addresses that the Inland Revenue Administration gave up their attempts.
- In the early 1980s in Cyprus many of the houses had steel reinforcement bars jutting out from their top floors. This was a way to avoid a building tax that applied only to finished structures. Owners of those houses could thus claim that they were still in the process of finishing the roof.

Taxation and Deadweight Loss/1

- The **DEADWEIGHT LOSS (DWL) measures the magnitude of the distortion created by taxes**:
  - Behavioural effects : individuals and firms make inefficient consumption and production choices in order to avoid taxation. Affected also choices related to labour supply, education, savings, investment.
  - Financial effects : transactions' forms are affected because they are treated differently (example: fringe benefit or firms' financial structure)
  - Organisational effects : family formation and distribution of well being within families, firms organisation
  - General equilibrium effects: indirect effects of taxes on wages or on the returns of capital
  - Announcement effects: usually adjustment to a new tax is slow, but announcements on future taxes may affect expectations and alter the behaviour of economic individuals and firms.

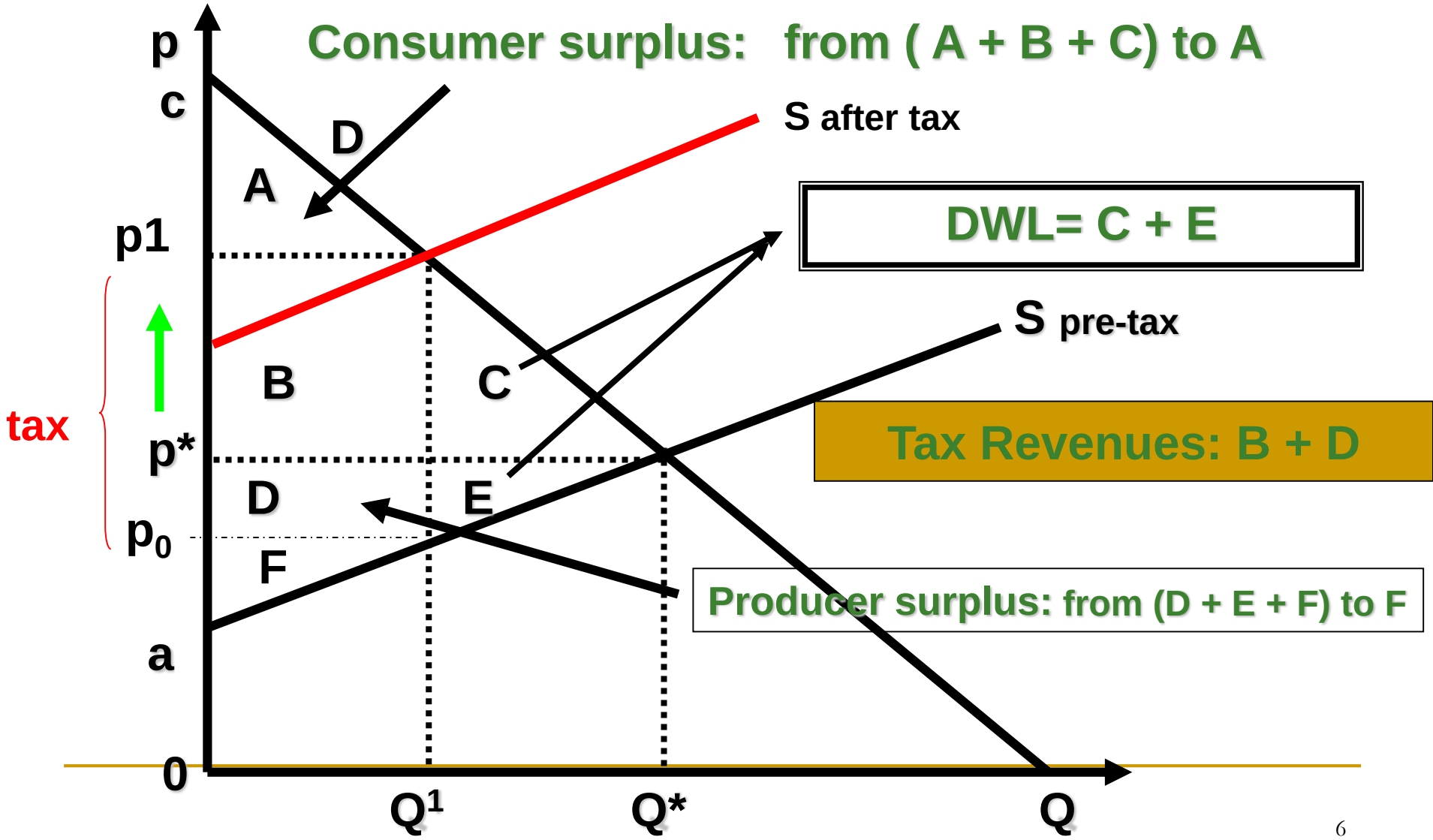
Deadweight Loss of a commodity tax

- Adding a per unit tax **t** (on the producer or the consumer) **increases the price and reduces the quantity traded** of the taxed commodity.
- **The efficiency loss (DWL) of the tax is determined by the reduction in quantity traded**. The loss affects both consumers and producers:
  - The **Consumer surplus** falls for two reasons:

    a) the consumer pays a higher price for the units still consumed: **area B**

    b) the tax rises the price more then the willingness to pay for some units that were previously consumed, so these units are not purchased and consumer surplus falls by **area C**
  - The **Producer surplus** falls because the quantity sold are lower than before **(area E)** and the price the producer gets for the units produced is lower **(area D)**.
- The **total loss of consumers and producers** in the market is **area (B+C+E+D)**
- However this is not the overall loss for society, because the **area (B +D) is government revenue from the tax** (given by the amount of the unit tax multiplied by the quantity sold in the market when the tax is in place). **The DWL is area C+E**

Welfare loss with a sales tax on production increasing the price above the competitive price p*: Consumers pay p_1 and producers get p_0



How a Commodity Tax Affects Welfare

	Without Tax	With Tax	Change
Consumer Surplus	A + B + C	A	−(B + C)
Producer Surplus	D + E + F	F	−(D + E)
Tax Revenue	None	B + D	+(B + D)
Total Surplus	A + B + C + D + E + F	A + B + D + F	−(C + E)

The area C + E shows the fall in total surplus and is the deadweight loss of the tax.

How big is the deadweight loss from a tax?

- The magnitude of the deadweight loss depends on how much the quantity supplied and demanded of the taxed good respond to changes in the price of the taxed commodity.

- This depends on the **price elasticities of supply and demand**.

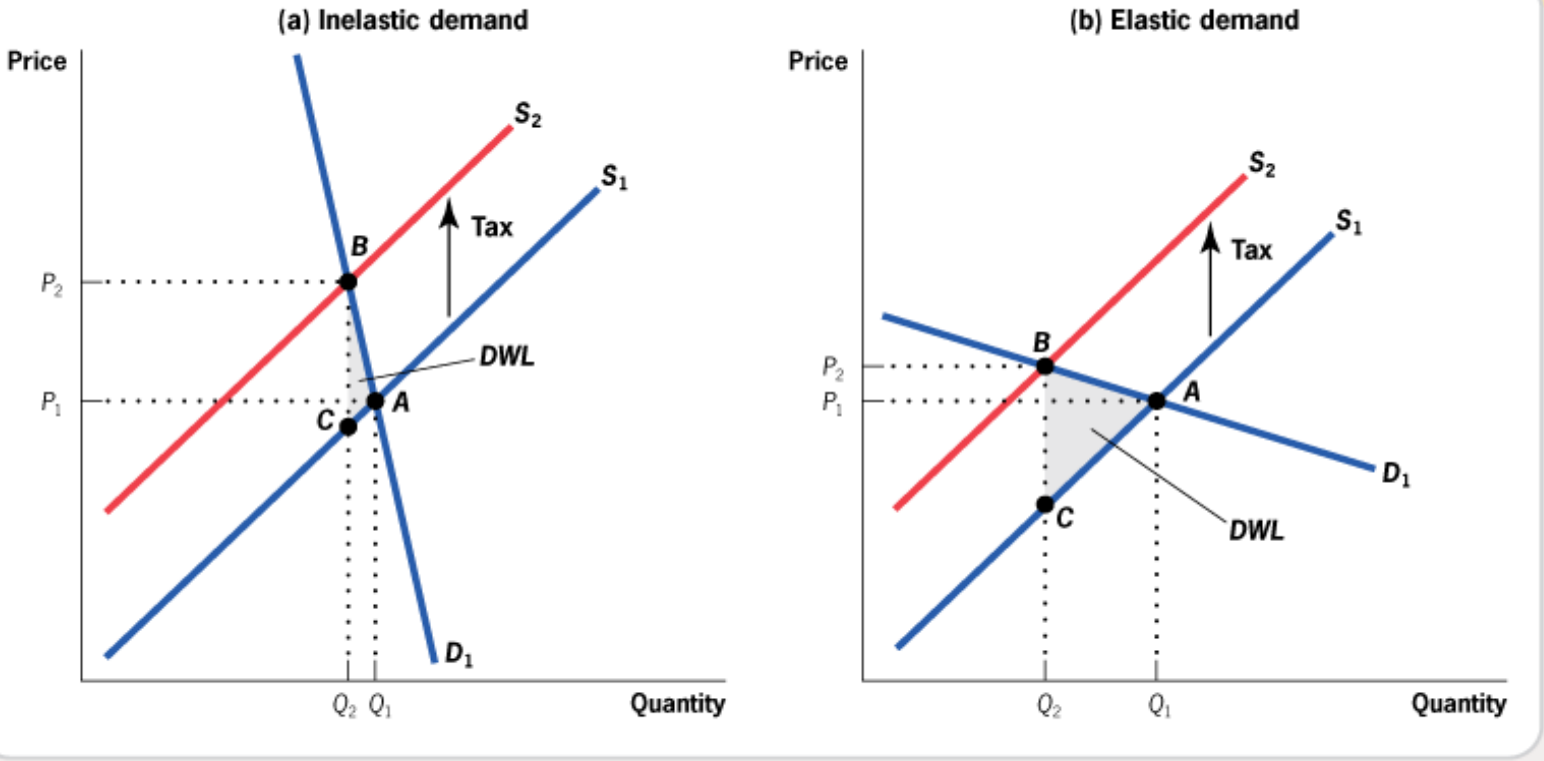
- **The greater the elasticities** of demand and supply, of the taxed good the larger will be the decline in equilibrium quantity and **the greater the deadweight loss of a tax**.

DWL and demand and supply elasticities

- **The DWL is higher the higher are demand and supply elasticities**.
- If the **demand curve of the taxed good is totally inelastic**, consumers will buy the same quantity of the taxed good regardless of its price and changes of prices do not distort consumption decisions. **There is no DWL, because there is no change in the quantity consumed.**
- Similarly if the **supply curve is totally inelastic**, the quantity produced is fixed and not affected by changes in prices hence no distortions occur.
- **If one of the curve is totally inelastic there is no DWL because there is no change in the quantity exchanged in the market**:
  - If **supply is completely inelastic** (vertical curve), the elasticity of demand is irrelevant
  - If **demand is completely inelastic**, the elasticity of supply is irrelevant.

DWL of a commodity tax: Elasticities Determine the size of the DWL (Tax Inefficiency)

■ FIGURE 20-2



Deadweight Loss Rises with Elasticities • The deadweight loss of a given tax is smaller when the demand curve is less elastic, as in panel (a), than when it is more elastic, as in panel (b).

J. Gruber (2007), Public finance and public policies, Fig. 20-2

Taxation and DWL: the DWL captures the substitution effect of taxation.

- A tax has *two effects on the quantity demanded of the taxed good/ service/ production factor* :

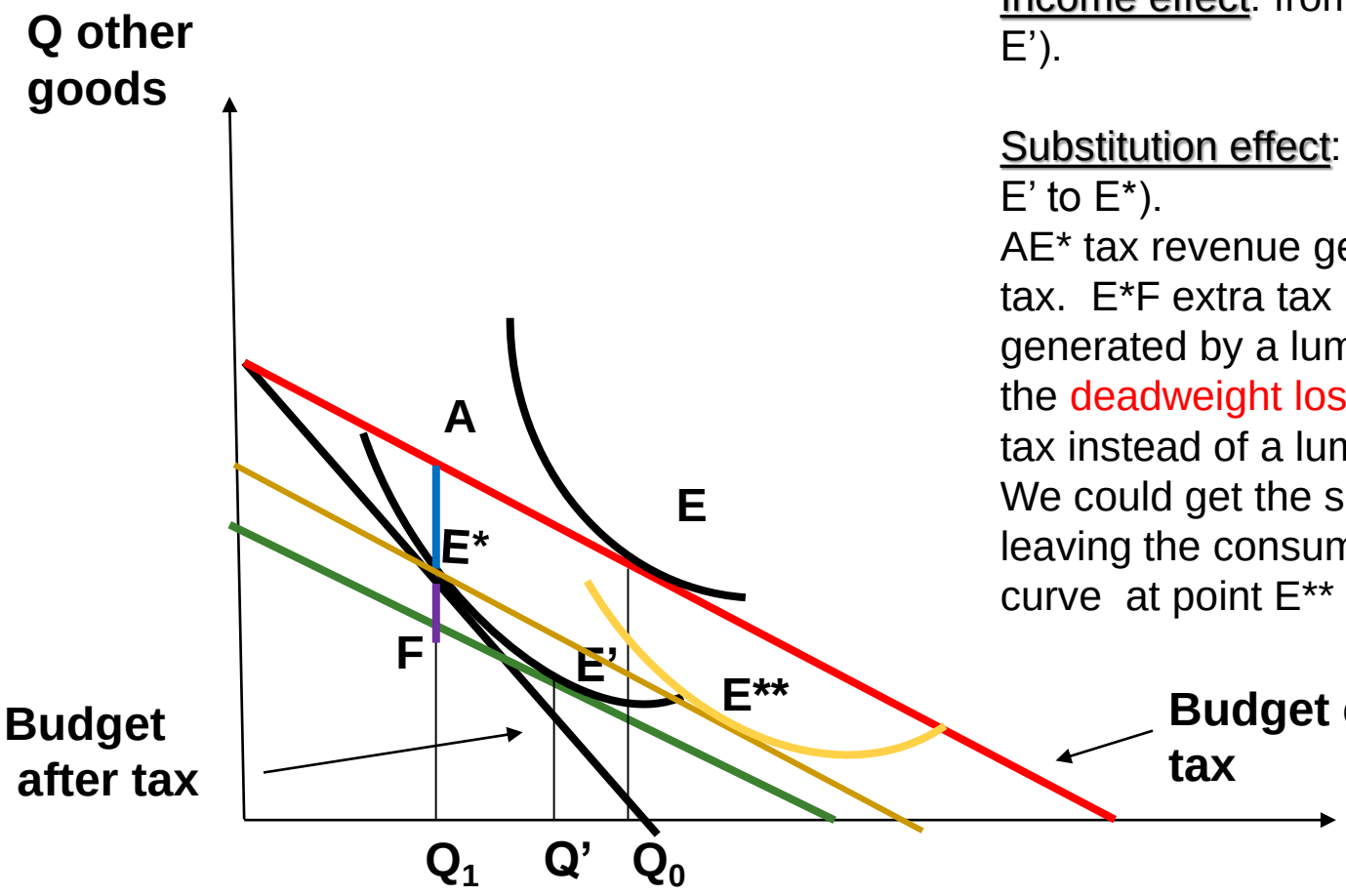
  a) an ***income effect*** leading to a decline in the demand of all goods/services. This effect is present also with lump sum taxes and does not generate DWL because is compensated by increased tax revenues

  b) a ***substitution effect*** which induces a decline in the consumption of the taxed good relative to others, due to changes in relative prices. **The DWL captures the substitution effect of taxation.**

Example

- If you always buy 50 apples and their price rises by 1 euro due to a tax, it's like losing 50 euro, which go to the government.
- But even if the 50 euro are returned to you, you will probably still buy fewer apples than before because their price is now higher relative to other commodities.

Example: income and substitution effect of a sales tax on beer



Total effect: from Q_0 to Q_1.

Income effect: from Q_0 to Q' (from E to E').

Substitution effect: from Q' to Q_1 (from E' to E*).

AE* tax revenue generated by the sales tax. E*F extra tax revenue that would be generated by a lump sum tax. This is the deadweight loss of adopting a sales tax instead of a lump sum tax.

We could get the same tax revenue AE*, leaving the consumer on a higher utility curve at point E**

Taxation and DWL

- A tax that alters relative prices reduces the individual utility more than it is necessary to raise the given amount of tax revenues.

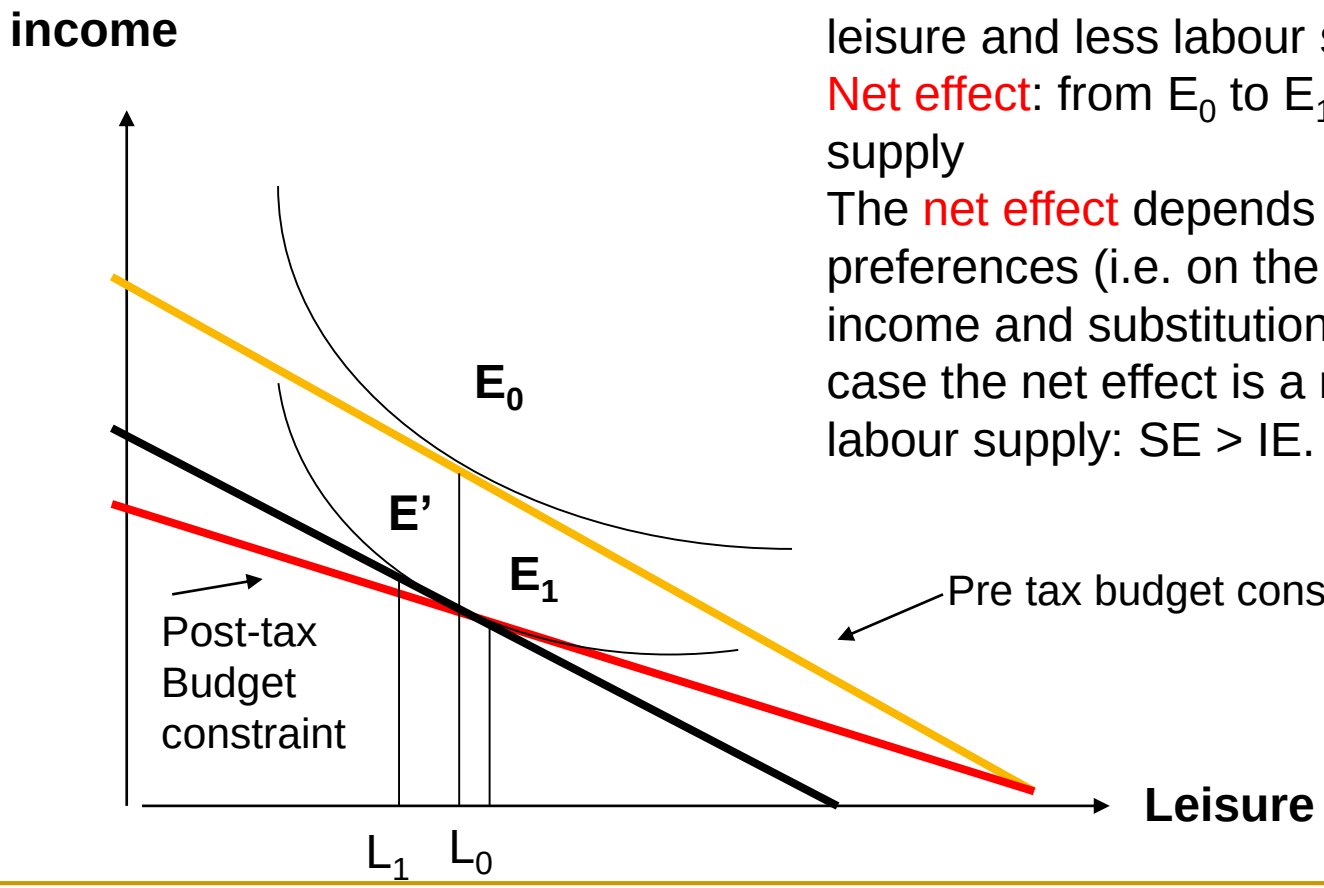
- In the figure above we can get the same tax revenue AE* leaving the consumer on a higher indifference curve (with only an Income effect). **The DWL measures the excess burden of the tax and its inefficiency**.

- *For a **tax on a commodity***, both the income and substitution effects lead usually to a reduction in the consumption of that commodity

Taxation and DWL: Tax on labour income and effects on labour supply/1

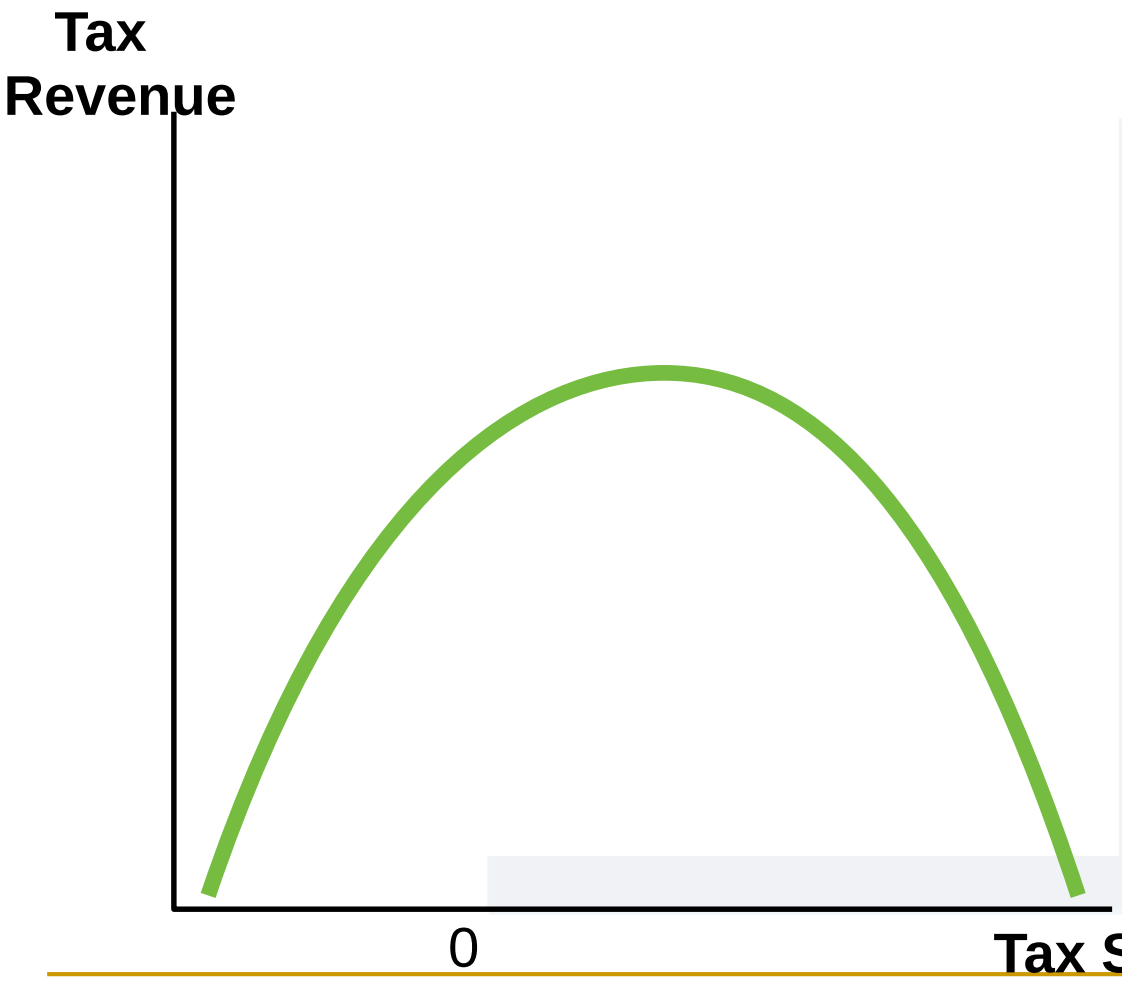
- A ***tax on labour income reduces net wages*** with an **effect on labour supply** that depends on the relative size of the income and the substitution effects:
  - the income effect increases labour supply,
  - the substitution effect reduces labour supply, since the "price" of leisure (opportunity cost) is the income forgone for not working, this declines when net wage declines and thus more leisure is demanded and less time is supplied in the labour market.
- **If the substitution effect is larger than the income effect**, taxation may have a **disincentive effect on labour supply**, reducing it. This effect is more likely at higher income levels.
  - Empirical evidence shows ***differences between men and women***: for men the income and the substitution effects are of the same magnitude and the net effect is null or very small (*inelastic labour supply);* for women the substitution effect is higher than the income effect and a decline in net wage reduces their participation to the labour market (*elastic labour supply*).

Disincentive effects of taxes on wages



Income effect: from E_0 to E' (less leisure, more labour supply);
Substitution effect: from E' to E_1 (more leisure and less labour supply).
Net effect: from E_0 to E_1: lower labour supply
The net effect depends on individual preferences (i.e. on the relative size of income and substitution effects). In this case the net effect is a reduction in labour supply: SE > IE.

The relationship between the tax rate on income and tax revenues: the Laffer Curve



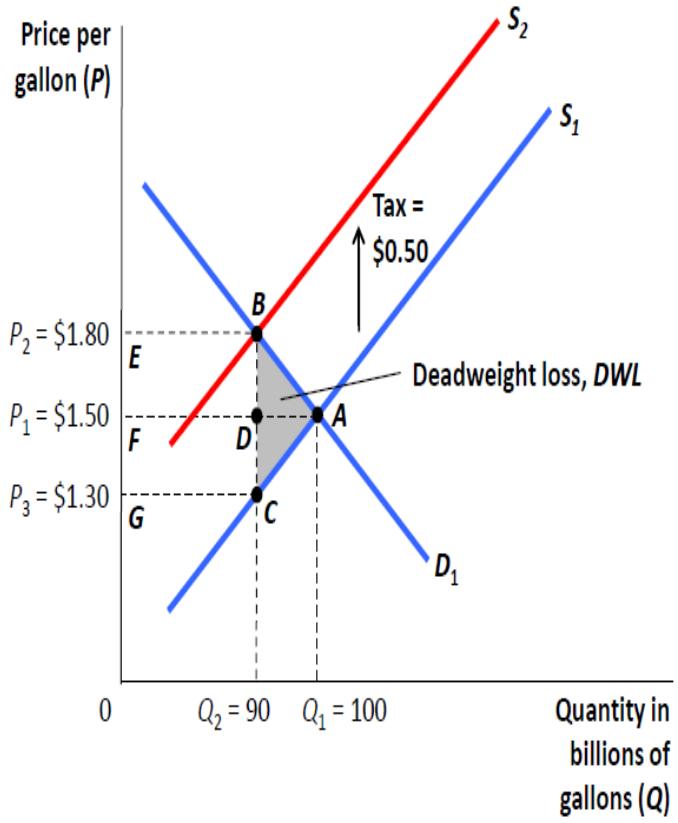
The *Laffer Curve* illustrates the relationship between tax rates and tax revenues: tax revenue (the product of the tax rate and total income) first rises with the size of a tax, but then, as the tax gets larger, the market shrinks so much that tax revenue starts to fall

Supply-side economics refers to the views of Reagan and Laffer who proposed that a tax cut would induce more people to work and thereby have the potential to increase tax revenues.

Taxation and DWL: Tax on labour income and effects on labour supply

- Some economists argue that income taxes are highly distorting and that labor supply is rather elastic.
- These workers may respond more to taxes (have a very elastic labour supply):
  - Workers who can adjust the number of working hours
  - Second earners
  - Elderly who can choose when to retire
  - Workers in the underground economy

Determinants of DWL/1



If the demand and supply curves are straight lines, the DWL can be approximated by the area of the triangle with base **t** and height **dQ** $=(Q_1 - Q_2)$:

DWL =-1/2 dQ dt.

We can express the DWL in terms of the elasticities of demand and supply:

- In **perfect competition** the **elasticity of supply is infinite:** the only relevant elasticity is that of demand. In this case the DWL is:

DWL = - (½) dt^2 η_d Q

- **More generally**, the formula for the DWL is:

$$DWL = -\frac{1}{2}\frac{\eta_s \eta_d}{\eta_s - \eta_d} \times \tau^2 \times \frac{Q}{P}$$

Determinants of DWL /2

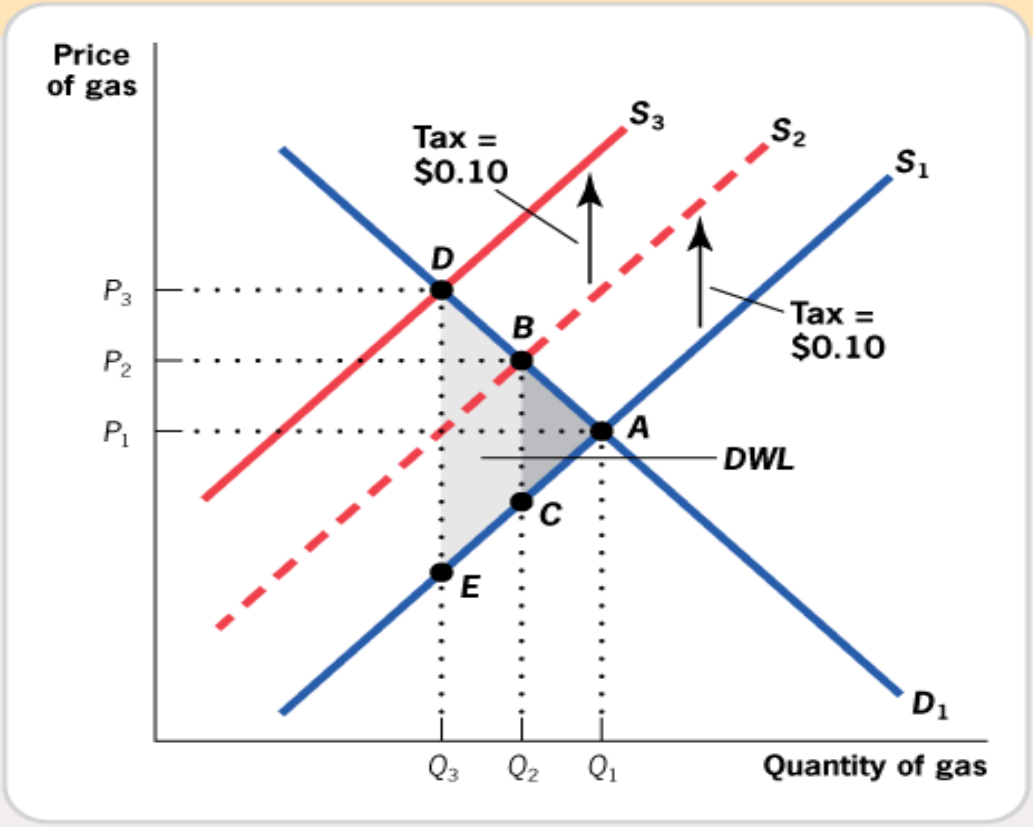
- In perfect competition the DWL of a tax is: **$DWL = -(\frac{1}{2})\, dt^2\, \eta_d\, QP$**
  and its dimension depends on **three variables:**

1. **The square of the *commodity tax rate* t:** the DWL rises with the square of the variation in the tax rate. The increase in DWL per unit increase in the tax (i.e. **the marginal DWL**) rises with the tax rate: doubling the tax rate more than doubles the DWL. **High tax rates are more distortionary than low tax rates and large fluctuations in tax rates produce higher DWL than tax smoothing.**
2. **The *elasticity (or flatness) of demand*** which measures how much the quantity demanded of a good/service change when its price changes**.** Deadweight loss increases with the absolute value of the elasticities (note that if the elasticity is zero, there is no DWB).
3. **The *size of the market for the taxed good/services:* Q**

The Marginal DWL raises with the Tax rate

The **marginal deadweight loss** is the marginal increase in the DWL per unit increase of the tax and raises with the tax rate. Given **DWL = - (½) dt^2 η_d Q,** then the marginal DWL is: **MDWL = - t η_d Q**

■ FIGURE 20-3



Marginal Deadweight Loss Rises with Tax Rate • An initial $0.10 tax on suppliers causes a deadweight loss triangle *BAC*. An additional $0.10 tax causes a much larger deadweight loss, *DAE*. The trapezoid *DBCE* is the marginal deadweight that is added to the initial deadweight loss of triangle *BAC*.

J. Gruber (2007), Public finance and public policies, Fig. 20-3

DWL and the Size of the Tax

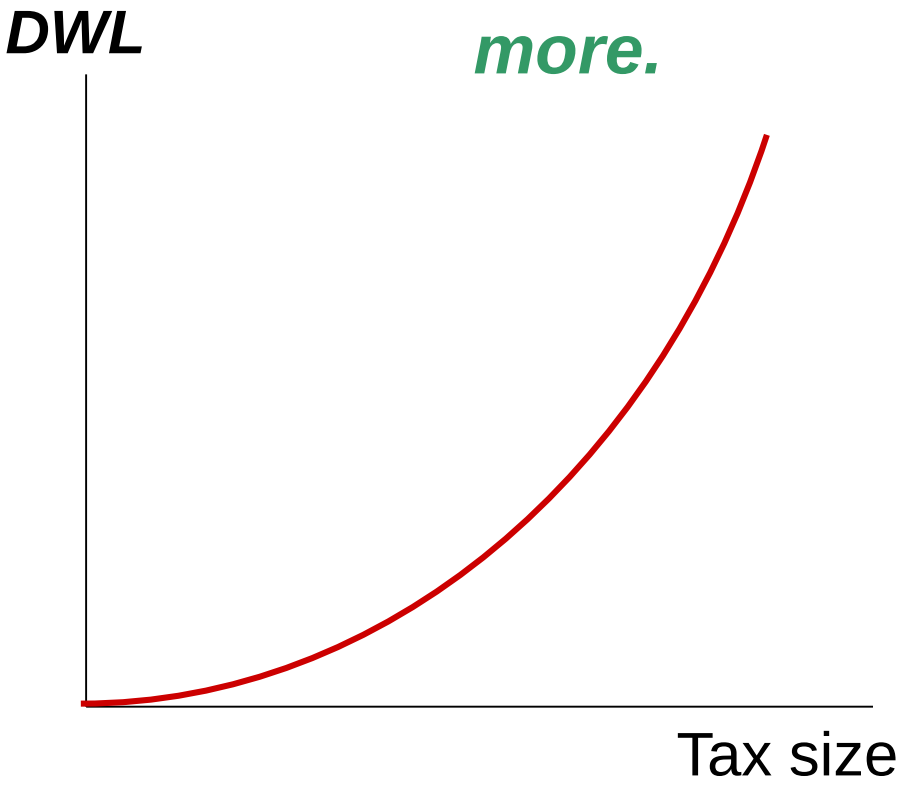
Implication:

As the size of a tax increases, its DWL gets quickly larger. When tax rates are low, raising them doesn't cause much harm, and lowering them doesn't bring much benefit.

When tax rates are high, raising them is very harmful, and cutting them is very beneficial.

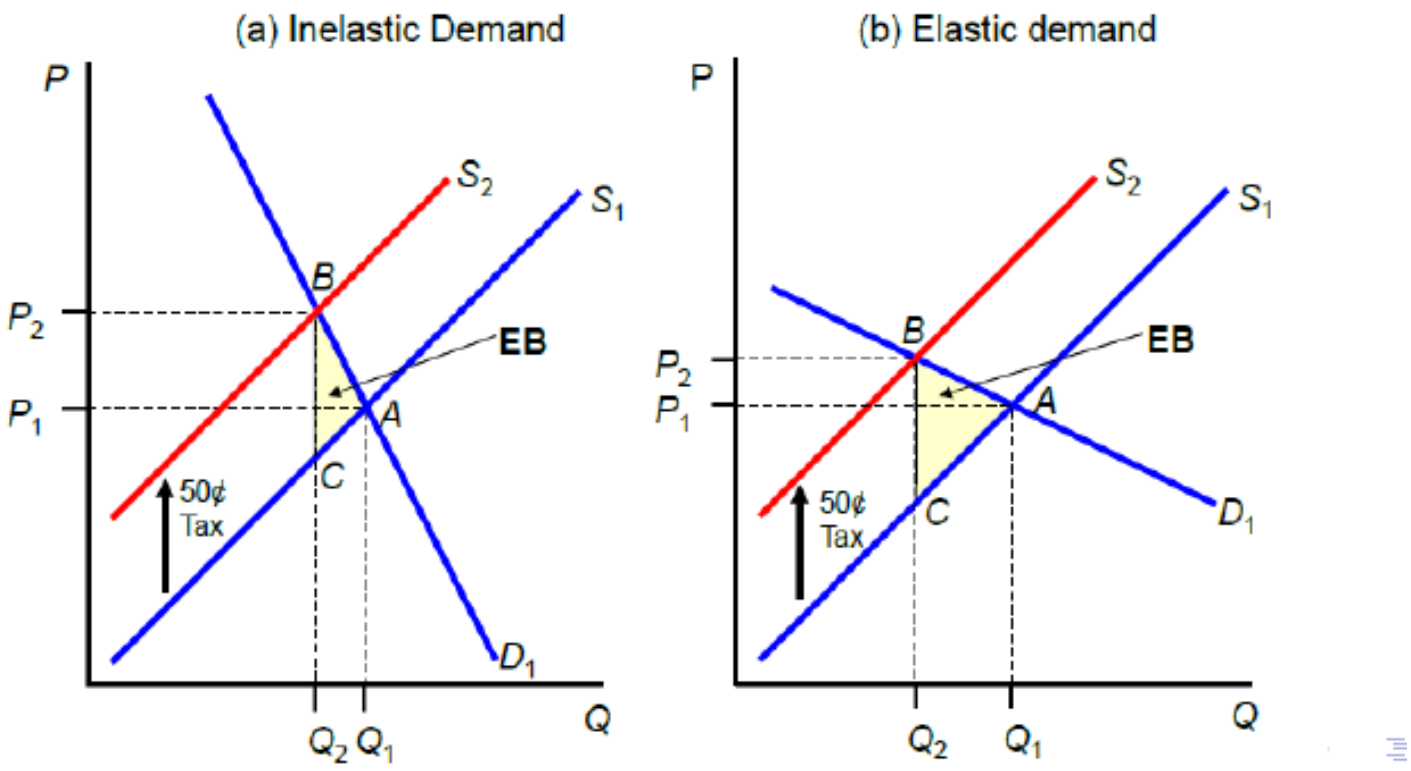
Summary

When a tax increases, the DWL rises even more.



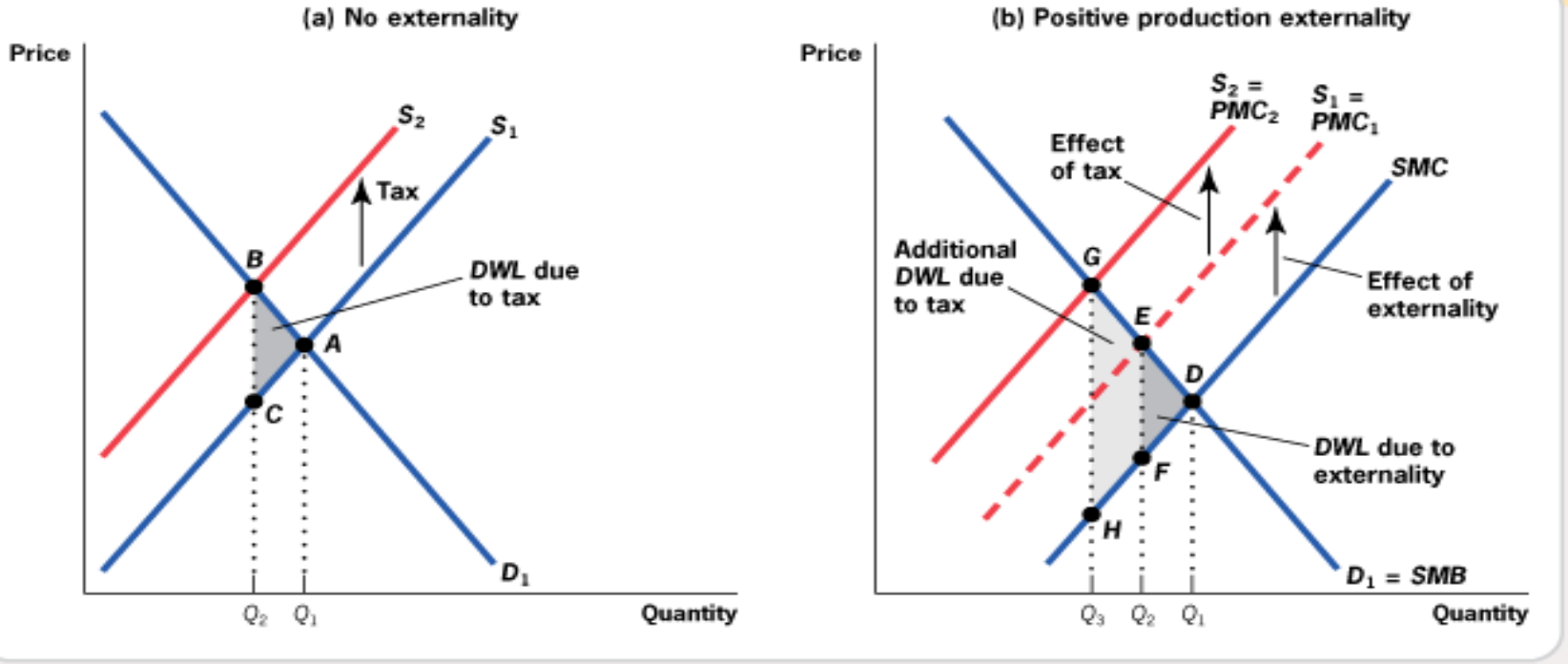
DWL increases with absolute value of elasticies

Figure 3: Comparative Statics



A Tax System's Efficiency Is Affected by a Market's Preexisting Distortions: The case of a pre-existing positive externality

■ FIGURE 20-4



Preexisting Distortions Matter • In panel (a), a tax in a market with no preexisting distortions (such as externalities) creates a deadweight loss equal to triangle *BAC*. In panel (b), a positive externality in the market has created a deadweight loss triangle *EDF*; imposing a tax on this market results in a dead-weight loss that is larger by the area of trapezoid *GEFH*. The total *DWL* in the market with a positive externality and a tax is the area of triangle *GDH*.

J. Gruber (2007), Public finance and public policies, Fig. 20-4

Summary/1

- A tax on a good reduces the welfare of buyers and sellers of the good, and the reduction in consumer and producer surplus usually exceeds the tax revenues raised by the government.

- The fall in total surplus—the sum of consumer surplus, producer surplus, minus tax revenue — is called the deadweight loss of the tax.

- Taxes produce DWL because they cause consumers to buy less and producers to sell less, thus shrinking the market below the level that maximizes total surplus.

Summary/2

- The price elasticities of demand and supply measure how much buyers and sellers respond to price changes. Therefore, higher elasticities imply higher DWLs.
- An increase in the size of a tax causes the DWL to rise even more.
- An increase in the size of a tax causes revenue to rise at first, but eventually revenue falls because the tax reduces the size of the market.

EXAMPLE: The Deadweight Loss of Taxing Wireless Communications

Hausman (2000) estimated the deadweight loss from taxing wireless communications services.

- Hausman estimated that for every dollar the government raised in taxes, social welfare was reduced by 53¢.

This figure is high for three reasons:

- **High elasticity of demand**: demand for wireless communications is fairly price sensitive.
- There is already a large **preexisting distortion** in this market.
- The **taxes are fairly high**, and the marginal deadweight loss rises with the tax rate.

Hausman estimated that the marginal deadweight loss caused by an additional tax on wireless services ranged from 72¢ to 90¢ per dollar raised.

Implications for tax policy

- With many goods the most efficient (keeping DWL as low as possible) way to raise tax revenue is:
  - **to tax relatively more the inelastic goods**, e.g. medical drugs, food. Strong **equity issues**
  - **to spread the taxes across all goods** so as to keep tax rates relatively low on all goods (because DWB increases with the square of the tax rate).

Tax smoothing

- In order to avoid the negative effects on the DWL of increasing tax rates over time, government efficiency in taxation over time is maximized by ***tax smoothing***, maintaining a relatively constant tax rate over time rather than high taxes in some periods and low taxes in others.