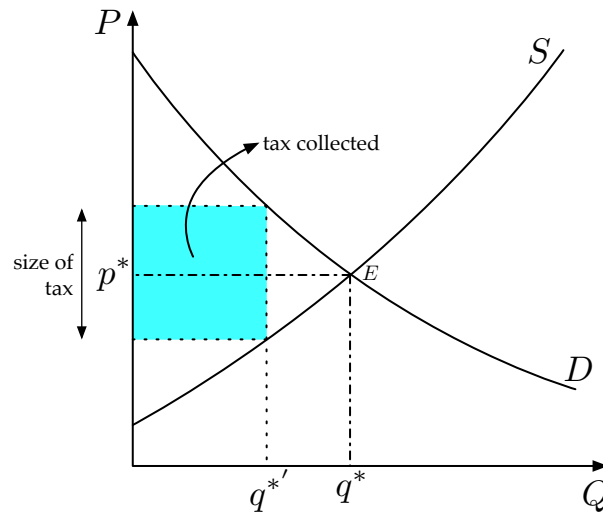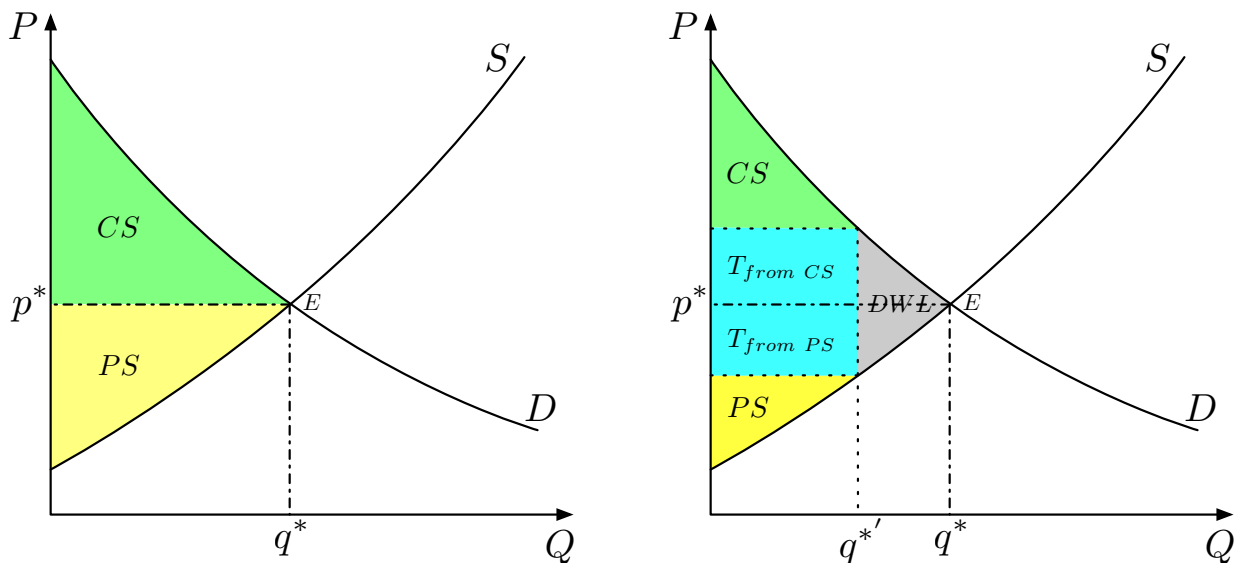# Handout 5

1 The Effect of Taxation

Regardless the tax(T) is imposed on the demand or supply side:

- Creates a wedge between the price buyers pay and the price sellers receive.

- Raises the price buyers pay and lowers the price sellers receive.

- Reduces the quantity of exchange.

The welfare analysis is illustrated on the graph above. On the right, you can see that the *blue area* (tax collected / tax revenue) eats up the surplus from consumer and producer. Whether one is larger depends on the **elasticity** of the Supply and Demand curve. The more **inelastic** side burdens more taxes.

2 Dynamic Analysis

It is very important to know how to determine the price paid by buyers (consumers) the price received by sellers (producers), the equilibrium quantities and the surplus of both demand and supply side. The analysis will focus on each side separately.

2.1 Tax impose on consumers
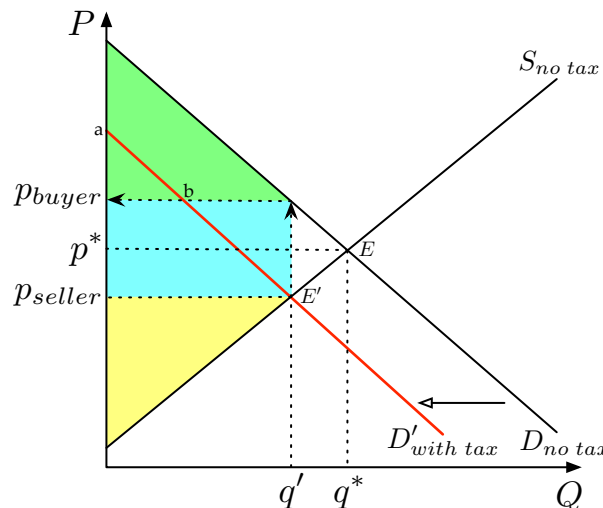
- The demand side consists of buyers which are the consumers and the households in the markets.

- Their demand curve, D(black line), illustrates their willingness to pay for a certain amount of quantity of goods.

- When the government imposes a tax on the consumer (on the demand side), the demand curve shifts leftwards ($\because$ for a given price, you can afford less amount of goods): D(black)$\to D'$(red).

- Find p_{seller}: First, we find the new market equilibrium. We equal the supply(no change) and the new demand, i.e. the intersection of S and D'(red line). The new equilibrium, E', characterizes the new equilibrium price and quantity: (p_{seller}, q').

- So we pin down the "price received by the seller": p_{seller}. Next, we need to find the "price paid by the buyers."

- Find p_{buyer}: To find the price for consumer, we need to refer to the demand curve, i.e. given a quantity q' what is the price that the consumer is willing to pay. So which is the "correct"demand curve for the consumers? D'(red) or D(black)?

- Previously, the demand curve shifts to the left due to tax. So D' is the demand curve that illustrates the "before-tax"willingness to pay. The "after-tax"willingness to pay will be $D' + tax$, which is the original demand curve D.

- For example, when a $5 tax is imposed on your consumption, given a specified quantity q', you refer to D' to find your willingness to pay, say $10. This indicates that you are willing to pay $10 for this good before tax. After adding the tax, you will pay $10 + $5 = $15. So given the quantity q', when you refer to D(original demand curve), you will get a price of $15.

- Hence, you can think of D' as the imaginary demand curve that tells you what is the buyer's willingness to pay before tax. D' is also the demand curve that is KNOWN by the seller. The sellers don't care about D since they don't want to know how much the buyers will pay after tax. They are only interested in the buyer's willingness to pay regardless the tax.

- For the consumers, D' is meaningless because they need to pay the tax. So when they are making the decision, they will only consider the after-tax price of \$15. Since \$15 is the final out-of-pocket money.

- When we want to find the consumer surplus(CS), we need to refer to D (not D') as the consumer's willingness to pay. So when a tax is imposed on the buyers, CS is NOT the (a-p_{buyer}-b) triangle BUT the large green triangle.

- The after tax producer surplus(PS) is the yellow triangle.

2.2 Tax impose on producers
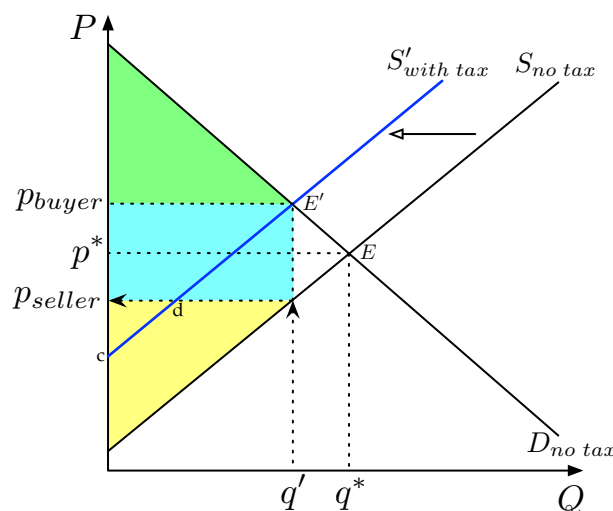
- The supply side consists of sellers which are the producers and the firms in the markets.

- When a tax is imposed on the producers, it will shift the supply curve leftwards: S(black)$\to S'$(blue).

- Find p_{buyer}: Since the demand curve is not affected, the price that consumers pay is determined by the new equilibrium: $E'(p_{buyer}, q')$.

- So given this new market equilibrium quantity q', the seller need to find the price that they will receive. To do this, the sellers need to refer to their supply curve given q'.

- The correct curve that illustrates the cost will be S, NOT S'.

- Why? Let the tax be \$5. Suppose at quantity q', referring to S' the seller can get \$15. But do all of \$15 go into seller's pocket? NO! The sellers need to pay a tax of \$5, so finally the sellers only receive \$15 - \$5 = \$10. This value of 10 is obtained from referring to S given the quantity of q'.

- In this case, the after-tax PS is the yellow triangle, NOT the small triangle (p_{seller}-c-d).

- The CS is the green triangle.

3 Tax and Deadweight Loss (DWL)

- Inelastic supply $\to$ harder for firms to exit market (Q drops a little bit) $\to$ small DWL when the tax is imposed on the seller.

- Elastic demand $\to$ easier for buyers exist (Q drops a lot) $\to$ large DWL.

- Government's objective: minimize DWL $\to$ determine whether the seller or the buyer is more inelastic, then impose the tax on them.

4 Optimal Tax

Government finance their ability of providing public goods from tax. In order to maximize their revenue from tax, is it a good strategy to impose a super large tax on the buyers or sellers?
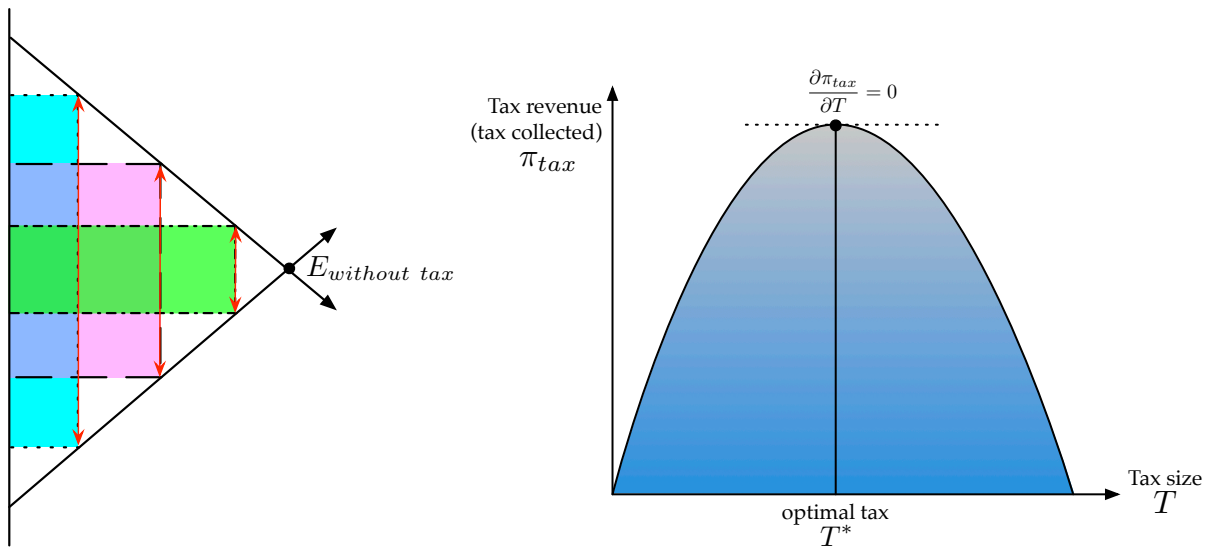
As you can see from the left figure above, a larger tax size doesn't mean the more tax revenue you will get. The second tax that generates the largest area of tax collected is the *optimal tax size*. To illustrate the relationship between tax imposed and tax revenue, we introduce the *Laffer curve* (right figure.)

5 Trade and Exchange

- A small economy is a price taker in world markets. It's actions have no effect on world price.

- A country will **export** a good if the world price of the good is higher than the domestic price without trade. Trade raises producer surplus[1], reduces consumer surplus, and raises total surplus.

---
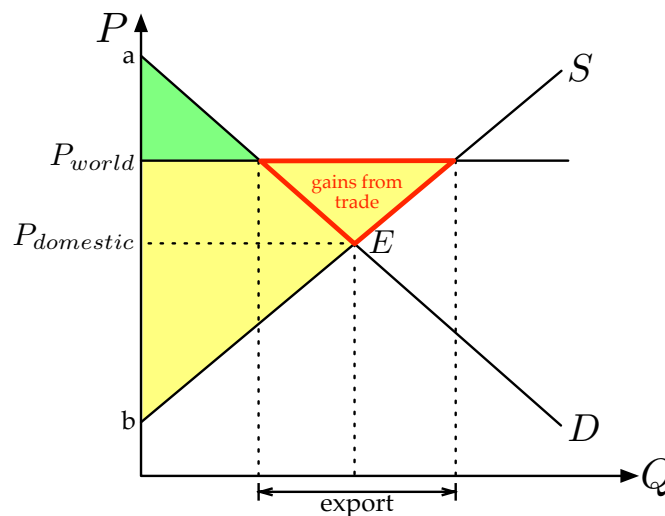
[1] In both figures the green area is the consumer surplus and the yellow area is producer surplus. Without trade, the total surplus is area (a-b-E).

- A country has a **comparative advantage** in a good if it produces the good at lower opportunity cost than other countries.

- Countries can **gain from trade** if each exports the goods in which it has a comparative advantage.

- A country will **import** a good if the world price is lower than the domestic price without trade. Trade lowers producer surplus but raises consumer and total surplus.
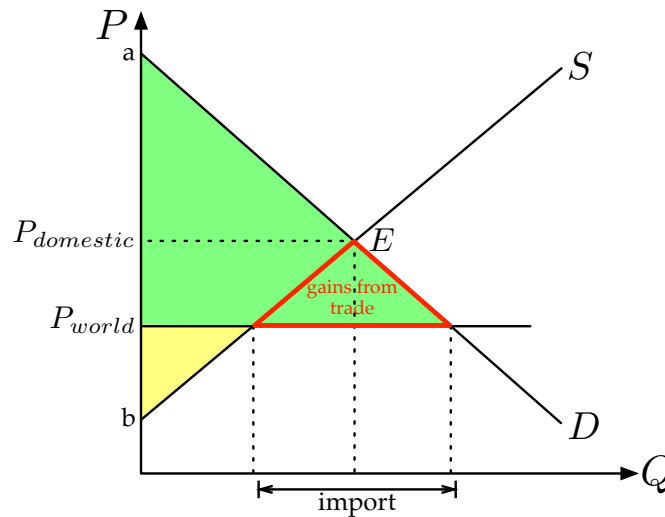

- Common arguments for restricting trade include: preventing unfair competition, helping infant industries, protecting jobs, defending national security, and respond in trade war.

5.1 Trade restriction

- Tariff: a tax on imports (P↑, reduces quantity of imports, CS↓, PS↑.)

- Import quota: a quantitative limit on imports of a good.

The following graph illustrates a *tariff on import*:
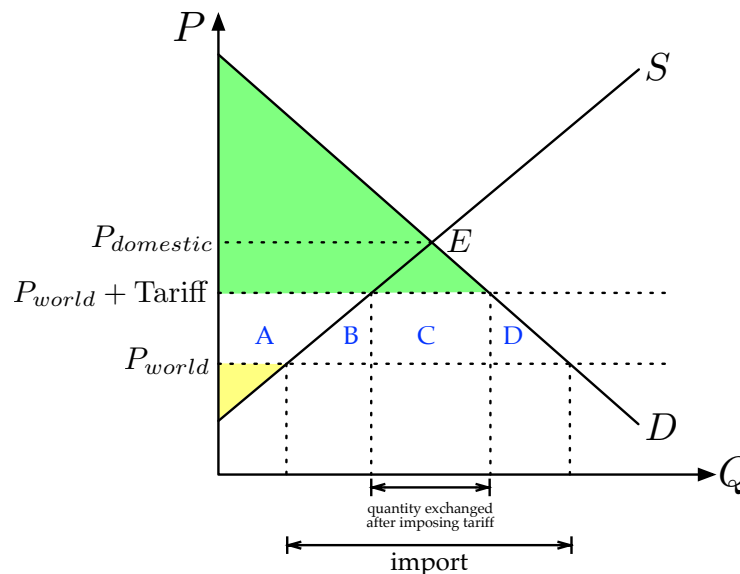
- Before Tariff: **CS** = green area + A + B + C + D, **PS** = yellow area

- After Tariff: **CS** = green area, **PS** = yellow area + A + C, **DWL** = B(over-production) + D(under-consumption)

6   Review

1. In Robert Heinlein's 1966 science-fiction novel, "There ain't no such thing as a free lunch,"refers to the principle

    (a) income must be earned
    (b) households face many decisions
    (c) people face tradeoffs
    (d) goods are scarce

2. Wells has the ability to grow either apples or oranges or some combination of the two. Given no other information, it follows that Wells' opportunity cost of a basket of corn multiplied by his opportunity cost of a basket of cotton

    (a) is greater than 1 but less than 2
    (b) is equal to 1
    (c) is equal to 2
    (d) less than 1

3. Market failure refers to

    (a) a market that fails to allocate resources efficiently.
    (b) ruthless competition among firms.
    (c) an unsuccessful advertising campaign which reduces demand.
    (d) a firm that is forced out of business because of losses.

4. The benefit to buyers of participating in a market is measured by

    (a) equilibrium price
    (b) price elasticity of demand
    (c) willingness to pay
    (d) consumer surplus

5. Assume both supply and demand curve are linear. When the government impose a $10 per unit tax on a good, it reduces the equilibrium quantity by 200 units. What is the deadweight loss from the tax?

    (a) $2,500
    (b) $500
    (c) $1000
    (d) $2000

6. When a buyer's willingness to pay for a good is equal to the price of the good

    (a) the buyer is indifferent between buying the good and not buying it
    (b) the price of the good exceeds the value that the buyer places on the good
    (c) the buyer will buy as much of the good as the buyer's budget allows
    (d) the buyer's consumer surplus for that good is maximized

7. The consumer will bear a larger part of the tax burden and the producer will bear a smaller part of the burden, when

    (a) the demand for the product is more elastic than the supply of the product
    (b) the tax is placed on the sellers
    (c) the tax is placed on the buyers of the product
    (d) the supply of the product is more elastic than the demand for the product

8. Total surplus in a market is

   (a) the difference between consumer surplus and sellers' cost.
   (b) the total value of the good to buyers minus the cost to sellers of providing the good.
   (c) the total cost to sellers of providing the good minus the total value of the good to buyers.
   (d) always smaller than producer surplus.

9. Efficiency is attained when

   (a) consumer surplus is maximized and producer surplus is minimized.
   (b) all resources are being used.
   (c) producer surplus is maximized.
   (d) total surplus is maximized.

10. Demand is said to be inelastic if

   (a) demand shifts only slightly when the price of the good changes.
   (b) buyers respond substantially to changes in the price of the good.
   (c) the quantity demanded changes only slightly when the price of the good changes.
   (d) the price of the good responds only slightly to changes in demand.

11. When the price of Beats headphone is $300, the quantity demanded is 400 packs per day. When the price falls to $200, the quantity demanded increases to 600. The demand for headphone is

   (a) inelastic.
   (b) perfectly inelastic.
   (c) unit elastic.
   (d) elastic.

12. The market for apples is initially in equilibrium. Suppose that there is a sudden drop in temperatures and this adversely affects the apple crop for this year. At the same time scientists discover that eating two apples a day significantly reduces the risk of colon cancer. Given this information and holding everything else constant, which of the following statements about the equilibrium is true?

   (a) The price and quantity of apples in this market will decrease.
   (b) The price and quantity of apples in this market will increase.
   (c) The price of apples is indeterminate and the quantity of apples will increase.
   (d) The price of apples will increase and the quantity of apples is indeterminate.

13. Initially the price of umbrellas in Irvine is $10 and 120 umbrellas are supplied and demanded at that price. This year however due to too much rain, the price of umbrellas has risen to $16 per umbrella and the equilibrium quantity of umbrellas demanded and supplied in the market has risen to 120 umbrellas. Given this information, which of the following explanations is the best explanation?

   (a) The supply curve has shifted to the right and the demand curve has also shifted to the right, but the supply curve shift is greater than the demand curve shift.
   (b) The supply curve has shifted to the left and the demand curve has shifted to the right, but the supply curve shift more than offsets the demand curve shift.
   (c) The demand curve has shifted to the right and there is a movement along the supply curve.
   (d) The supply curve has shifted to the right and there is a movement along the demand curve.

14. Suppose that you are told that Mindy has a linear production possibility frontier and that two points on this production possibility are (2 pens, 4 erasers) and (4 pens, 3 erasers). Given this information, what is the maximum amount of pens that Mindy can produce?

   (a) 5 pens
   (b) 10 pens