

Lecture XII: Market Equilibrium – The Competitive Market

Charles B. Moss

July 17, 2014

Readings

Market Equilibrium

More Change in Surplus

Readings

- ▶ Becker Lecture 20
- ▶ Friedman & Friedman Introduction & Chapter I

Market Equilibrium

- ▶ Building on the conjectures from Lecture I - the market is in competitive equilibrium at that price where the quantity demanded equals the quantity supplied as depicted in Figure 1

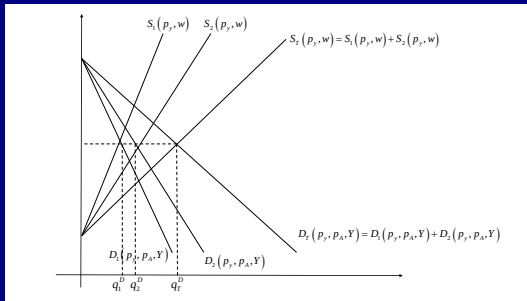


Figure : Competitive Equilibrium

- ▶ As depicted in Figure 1, the supply function is the horizontal summation of the individual supply curves – the total quantity that will be offered to the market for any price

$$S_T(p, w) = \sum_{i=1}^N S_i(p, w). \quad (1)$$

Notice that each individual firm reacts to the price of the inputs so the aggregate supply function is a function of the price of the input.

- ▶ In the same way, the market demand function is the horizontal summation of the individual demand functions

$$D_T(p, \{Y_i\}_{i=1}^N) = \sum_{i=1}^N D_i(p, Y_i) \quad (2)$$

where $\{Y_i\}_{i=1}^N$ is the collection of the incomes for each individual. An interesting point is whether individual consumer incomes, average consumer income, or total consumer income matters.

- ▶ The market equilibrium occurs at

$$p \Rightarrow S_T(p, w) = D_T\left(p, \{Y_i\}_{i=1}^N\right). \quad (3)$$

- ▶ At this point what happens? The marginal value of the last unit of output for all consumers is equal to the marginal cost of production of all producers.
 - ▶ If $p \ni: S_T(p, w) > D_T(p, \{Y_i\}_{i=1}^N)$ then for the last unit the marginal value to consumers is less than the marginal cost of production.
 - ▶ If $p \ni: D_T(p, \{Y_i\}_{i=1}^N) > S_T(p, w)$ then for the last unit the marginal value to consumers is greater than the marginal cost of production.
 - ▶ In either case, the consumers and/or producers can be made better off by reallocating inputs to produce less or more output, respectively.

Decomposition of Supply

- Note that while Figure 1 presents the decomposition of the quantities to different consumers, Figure 2 present the decomposition of the equilibrium to different producers.

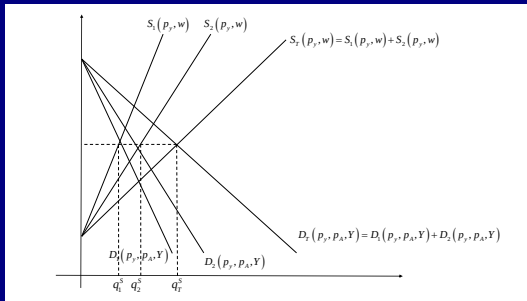


Figure : Decomposition of Supply

- Next, consider the effect of reduction in the price of the input used in production. In the case where the individual supply curves shift out as depicted in Figure 3

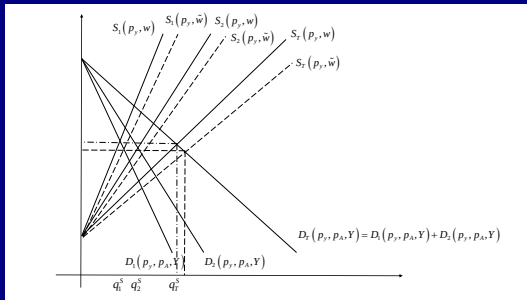


Figure : Shift in Supply

- ▶ In the case of each firm the supply curve shifts to the right (or rotates outward) because the firm can now produce more output for any given price.
- ▶ Looking forward to the firm's problem a little more

$$\max_x p_y f(x) - wx \Rightarrow p_y \frac{\Delta f(x)}{\Delta x} = w \quad (4)$$

within the relevant range of production the marginal product curve is downward sloping so the quantity of input used increases for any p_y and the output increases.

- ▶ Hence, the aggregate supply curve shifts outward (to the right)

$$S_T(p_y, \tilde{w}) = \sum_{i=1}^N S_i(p_y, \tilde{w}) \geq S_T(p_y, w) = \sum_{i=1}^N S_i(p_y, w) \quad \forall p_y.$$

(5)

- ▶ The market equilibrium price declines and the quantity produced and consumed increases.
- ▶ Figure 4 presents the effect of this change on consumer surplus.

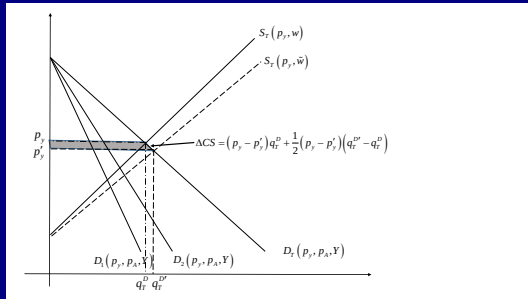


Figure : Effect of Shift on Consumer Surplus

- ▶ At the original equilibrium the consumers are willing to pay p_y for the quantity q_T^D .
- ▶ After the shift in supply the consumers now pay $p'_y < p_y$ for a greater quantity $q_T^{D'} > q_T^D$.
- ▶ Taking the simple argument – consumers have gained at least $(p_y - p'_y) \times q_T^D$. They now pay less for their original quantity of consumption. They could use this income on other things.
- ▶ The rest of the area depends on a nasty limit concept.

- ▶ First divide the gain up into two portions
 $p_y^* = 1/2 \times (p_y - p'_y)$. Associated with this price there is a quantity demanded q_T^{D*} .
- ▶ The gain is now the sum of the two rectangles.

$$\Delta CS \approx (p_y - p_y^*) \times q_T^D + (p_y^* - p'_y) \times q_T^{D*}. \quad (6)$$

- ▶ If we continue to divide the range in halve an infinite number of times, the result is then the total area

$$\Delta CS = (p_y - p'_y) \times q_T^D + \frac{1}{2} (p_y - p'_y) \times (q_T^{D'} - q_T^D). \quad (7)$$

- Next, we shift the demand outward by increasing the price of a substitute as depicted in Figure 5.

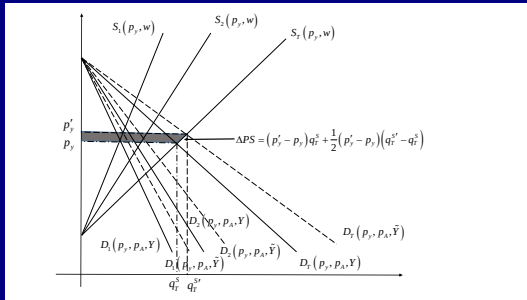


Figure : Outward Shift in Demand

- ▶ The supply curve is the marginal cost curve – the change in cost.
- ▶ Hence, the area under the marginal cost curve is the total cost curve.
- ▶ Hence, the total revenue from $p_y \times q$ while the cost of producing the extra output is
$$p_y \times (q_T^{S'} - q_T^S) + 1/2 (p'_y - p_y) \times (q_T^{S'} - q_T^S).$$

More Change in Surplus

- Consider the shift in supply presented in Figure 6.

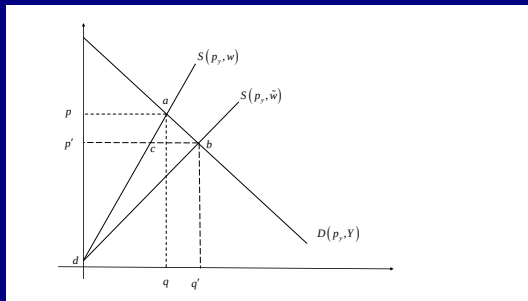


Figure : More Complex Change in Producer and Consumer Surplus

- ▶ The welfare analysis includes changes in both consumer and producer surplus.
 - ▶ Following our discussion of consumer surplus – consumers gain $pabp'$.
 - ▶ The gain to producers is a little more complex.
 - a. Producers lose $pacp'$ as the price falls.
 - b. However, they gain cbd as the cost of production declines.