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Lecture note 2

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[*This lecture note covers materials from various sources. Supplementary reading materials includes GdR Chapters 2, 3, and some additional reading materials (Supl. ch 5, 7) that will be posted in Canvas. In addition, also consult the "Veileder i samfunnsøkonomiske analyser" section 3.3, and 3.4*]

Quantifying effects in the impacted market

So far, we have considered a general framework to quantify the impact of a policy by measuring the changes in social surplus within a market.

Ignoring the non-price goods for the time being, we can broadly classify the impacted markets into three categories: the output market, the input market, and the secondary market.

Measuring the change in surplus critically depends on whether we are dealing with an efficient or an inefficient market.

Recall that a market is allocatively efficient if the output is produced up to the level at which the marginal benefit is equal to the marginal cost. Consequently, the social surplus is maximized at the equilibrium production level.

If the market is efficient, then there will be no deadweight loss before or after the policy/project is implemented. We can, therefore, rule out the possibility of measuring changes in the deadweight loss due to policy intervention.

Below, we will consider some simple examples to illustrate how we can quantify changes in consumer surplus, producer surplus, and net government revenue in these three types of markets for various policy interventions.

The output market

We will start with examples concerning efficient market.

Example 1

Project (a): Suppose the government possesses certain good in excess quantities that it can supply to the market.

Then the supply curve shifts to the right, resulting in an increased availability of goods to consumers at various price points. However, if this increase in supply is relative insignificant compared to the overall market supply, price may not drop.

Let's initially examine the scenario where price remains unaffected. If the government chooses to sell the additional units of the goods at the prevailing market price, it will be treated akin to other competitors in an efficient market. In this context, it will encounter a horizontal demand curve labeled as D.

Consider Figure 1, illustrating a rightward shift in the supply curve while maintaining the price at P_0.

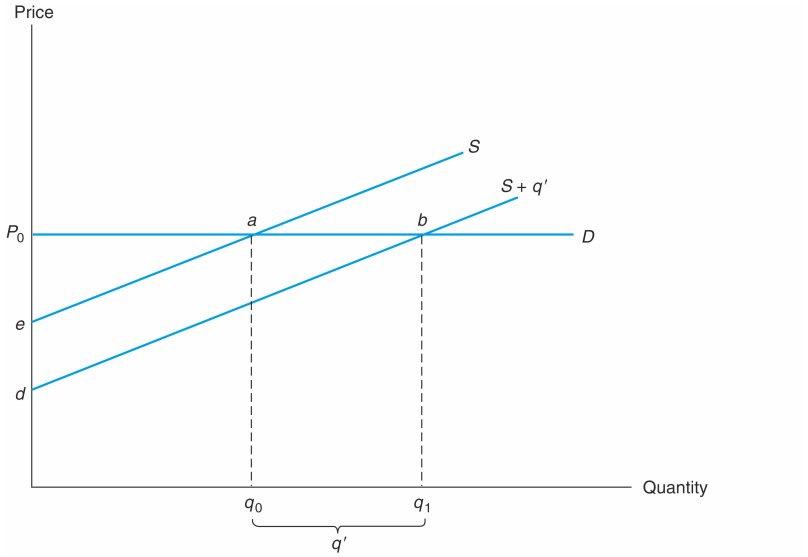


Figure 1: Shift of supply with no effect on price

What will be the extent of the surplus change resulting from a shift in the supply curve?

Given our exclusive focus on the output market, we can identify the affected parties as the consumers and producers within this market.

The demand curve being horizontal, the change in consumer surplus is zero. The interpretation is that even if these additional quantities being sold, what the consumers pay are the same as what they are willing to pay.

The change in producer surplus is also zero; albeit with a more intricate rationale. Despite the rightward shift observed in the supply curve, there is no reduction in the marginal costs of production for the units sold earlier.

The government receives revenue equal to P_0 times q', the area of rectangle q_0abq_1. The revenues received by the government are the only benefits that accrue from the project selling q' units in the market.

Suppose the government instead of charging the price P_0, offers the good for free. Then, the rectangle q_0abq_1 will constitute a positive change in consumer surplus with zero government revenue. Thus, whatever price government charges, the net gain from this shift of supply curve will remain unchanged and is measured by the area q_0abq_1.

Here we ignore any additional costs of inputs to supply the surplus good to the market. Had there been any costs, it should be included in the calculation as well.

Project (b): Consider an alternative possibility in which the shift of the supply curve happens not due to the supply of some surplus goods, but because of an investment that reduces marginal costs of production. Such a reduction will move the supply curve downward and can be illustrated by a similar rightward shift as depicted in Figure 1.

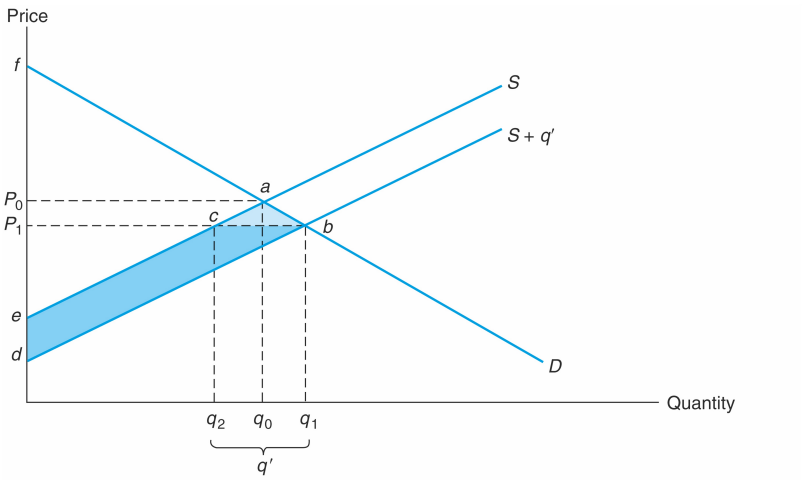
In this case, measure the change in surplus for producer will be different. It will be represented by the trapezoid $abde$. No change in consumer surplus as before, due to the perfectly elastic horizontal demand curve at P_0.

Example 2

Next, consider a possibility similar to the project (a) above but assume that price moves downward due to a shift of the supply curve. Figure 2 illustrates this scenario with a downward sloping demand curve D.

Due to drop in price, there is an increase in consumer surplus, measured by the trapezoid P_0abP_1.

The new equilibrium demand is q_1. The production level comprises of two kinds of good, one was originally produced with an upward sloping marginal costs curve, of volume q_2, and the surplus volume that the government supplies of $q_1 - q_2 = q'$ units.



Social surplus change (ignoring costs of project inputs to the government):
Project (a): Direct increase in supply of q'—gain of triangle *abc* plus project revenue equal to area of rectangle q_2cbq_1
Project (b): Supply schedule shift through cost reductions for producers—gain of trapezoid *abde*

Figure 2: Shift of supply curve resulting in price reduction

As the shift of supply curve is not due to a reduction of the marginal costs, it implies that producer surplus must be going down on the earlier production volume q_2, and this reduction is measured by the trapezoid P_0acP_1 .

And, there is an additional government revenue from selling the surplus good, measured by the rectangle q_2cbq_1.

Adding these three changes, we can find that the total change in surplus will be the area of q_2cabq_1.

As before, we assume that the surplus volume was available and could be supplied at zero costs. Otherwise, the cost of producing/supplying the additional goods should also be taken into account.

Project (b): We can also consider an alternative possibility in which the shift of the supply curve happens because of an investment that reduces marginal costs of production. Such a reduction will move the supply curve downward and can be illustrated by a similar rightward shift as depicted in Figure 2.

In this case, measure the change in surplus for producer will be different. The producer surplus before the project is the triangle P_0ae and the producer surplus after the project is the triangle P_1bd. Therefore the change in producer surplus is the trapezoid *ecbd* - the trapezoid P_0acP_1.

There will be a gain in consumer surplus, measured by the area of the trapezoid P_0abP_1.

Adding all of them, the net change (gain) in surplus will be measured by the area *eabd*.

The above two examples illustrate the effects of a shift in the supply curve, either due to the supply of surplus volume or a reduction in marginal costs, within an efficient market.

In cases of market inefficiency, determining the changes in surplus can become more intricate. This complexity arises from the presence of deadweight loss at the market equilibrium, both prior to and following the implementation of a policy.

As we covered in the previous lecture, taxes or subsidies can lead to allocative inefficiency (resulting in deadweight loss) in an otherwise efficiently functioning perfectly competitive market. Additionally, other factors can contribute to market inefficiency, such as monopoly, information asymmetry, and externalities, among others.

The secondary markets

A project's effects can be extended to markets beyond the primary output market. Suppose that undertaking a project results in a lower price for a good.

It is expected that the demand for a complement product would increase. If this complementary product is in perfectly elastic supply, there will be no change in its price.

However, since the demand curve for the product has shifted right, the area of consumer surplus measured under the demand curve must have increased.

Should this increase in consumer surplus be measured and included in CBA?

In theory, the answer depends on whether the secondary market is efficient (such that the price there equals the marginal costs of production) or distorted.

Consider first the case of an efficient second market. We refer to Figure 3(a), in which we consider a project that reduces marginal costs of production in the primary market resulting in a drop of price. In Figure 3(b), we observe a rightward shift of the demand curve of a complementary good.

No price change

Suppose the secondary market has a perfectly elastic supply curve, and therefore there will be no price change even after the demand shift. The question is whether we should include the apparent gain in consumer surplus, measured by the area $cdfe$ in our analysis?

The answer is no.

The shift in demand within the market for the complementary good reflects consumers reallocating their expenditures to capitalize on the lower price of the good provided by the project. The advantage of this lower price is comprehensively quantified by the change in consumer surplus, as measured in the project's output market.

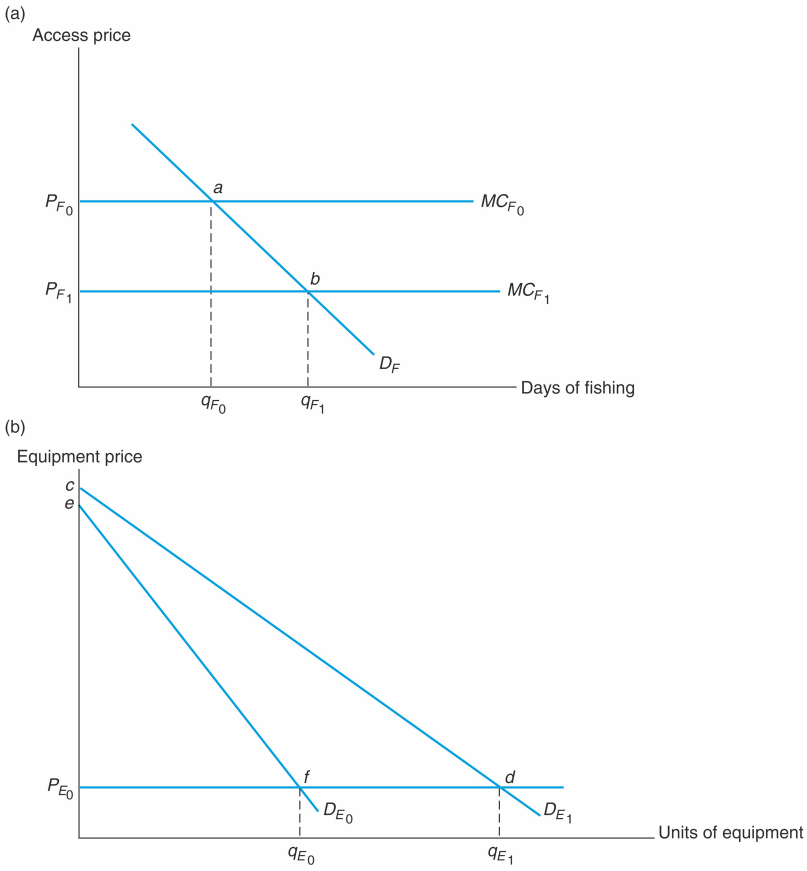


Figure 3: Efficient secondary market with no price effect

To illustrate this point (refer to supplementary material Chapter 7 for further discussion), let's consider the example of stocking a lake near a city with fish, which subsequently reduces fishing costs for residents. As depicted in Figure 3(a), this leads to an increase in the number of fishing days for residents and results in a gain in consumer surplus.

The market for fishing equipment constitutes a secondary market and has witnessed an upswing in demand, as indicated in Figure 3(b). However, accounting for this surplus gain in the secondary market would result in duplicating the benefits.

To understand why, let's recognize two types of consumers that could potentially comprise the additional consumer base in the primary market: those who already possess the equipment and thus would not contribute to the supplementary demand for equipment, even if their valuation for it has increased; and those who previously lacked the equipment and could now join the augmented demand in the secondary market.

Nonetheless, for the second type of consumer, their willingness to pay for fishing days in the primary market has already factored in the potential benefits and costs of acquiring the equipment in the secondary market. Consequently, their net benefits are encompassed in our calculation of the change in consumer surplus in the primary market.

With price change

Suppose the price changes in the secondary market. Can we still disregard the change in surplus there to avoid double counting? The answer is yes, but the argument is somewhat more intricate.

(TBA)