Weeks 6 and 7 Notes: Externalities and public goods

ENVS 30, Fall 2025 - Anna Pede

1 Externalities

As in Keohane and Olmstead (2016), externalities can be defined as:

An externality results when the actions of one individual (or firm) have a direct, unintentional, and uncompensated effect on the well-being of other individuals or the profits of other firms.

In class and in the exercises you worked on, the negative externalities of a given good are represented by the marginal damage curve. The idea is straightforward; the marginal damages curve represents, at each level of q, the social damage brought by that unit of the good.

The core idea to keep in mind is that when externalities exist, the market will overprovide the good. First, remember that the Social Marginal Cost (SMC) curve shows how we internalize the social cost (negative effects) of this market. We find it by remembering that:

$$SMC = MC + MD \tag{1}$$

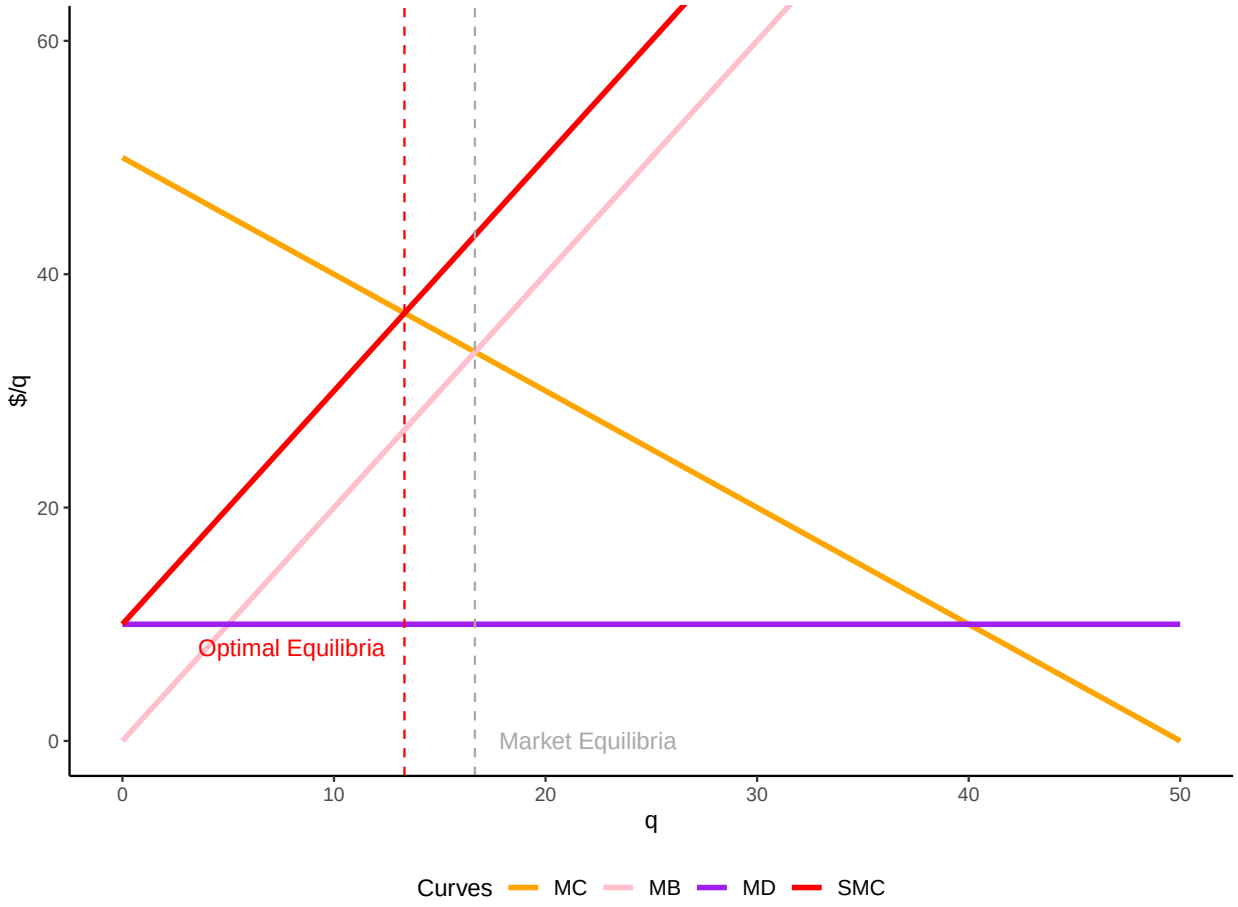
where MC represents the costs to the firm of producing the good and MD represents the social damages from the production. Note that when $MD = 0$, $SMC = MC$. Hence, SMC incorporates both the private and the social costs of production.

The graph below shows why the market equilibrium q_m will be above the socially optimal q_s when there is an externality. In other words, because we are incorporating the negative externality (adding the MD to the MC curve), the SMC will always be above the MC, and hence the equilibrium will shift to the left (reducing q).

Lastly, remember that under negative externalities, Welfare is calculated as:

$$Welfare = CS + PS - TD \tag{2}$$

That is, it incorporates the total damages borne by society. Without externalities, $TD = 0$ and the benefits from this market are limited to the gains from trade felt by consumers and producers - given by CS and PS.



2 Public goods

Public goods are closely related to the concept of an externality. First, remember that a public good must have the following characteristics:

1- Nonrival: one person's consumption does not reduce the amount available of the good to others.

2- Nonexcludable: cannot prevent others from enjoying it.

And what is the connection with an externality? Imagine a UCSB association promoting beach clean-ups, thereby providing cleaner beaches for Goleta residents. We can think that by taking care of the Goleta beaches, this association is providing a positive externality for everyone.

The key concept you should keep in mind is that the private provision of a public good will be inefficiently low. Let's check that with a numeric example. Imagine that Santa Barbara and Goleta share the responsibility of cleaning Sands Beach. Here, the public good is the clean beach. They have the following marginal benefit curves:

$$MB_{SB} = 120 - 3q \tag{3}$$
$$MB_{GO} = 40 - q \tag{4}$$

The marginal cost curve of cleaning the beach is the same for both cities and is given by:

$$MC = 4q \tag{5}$$

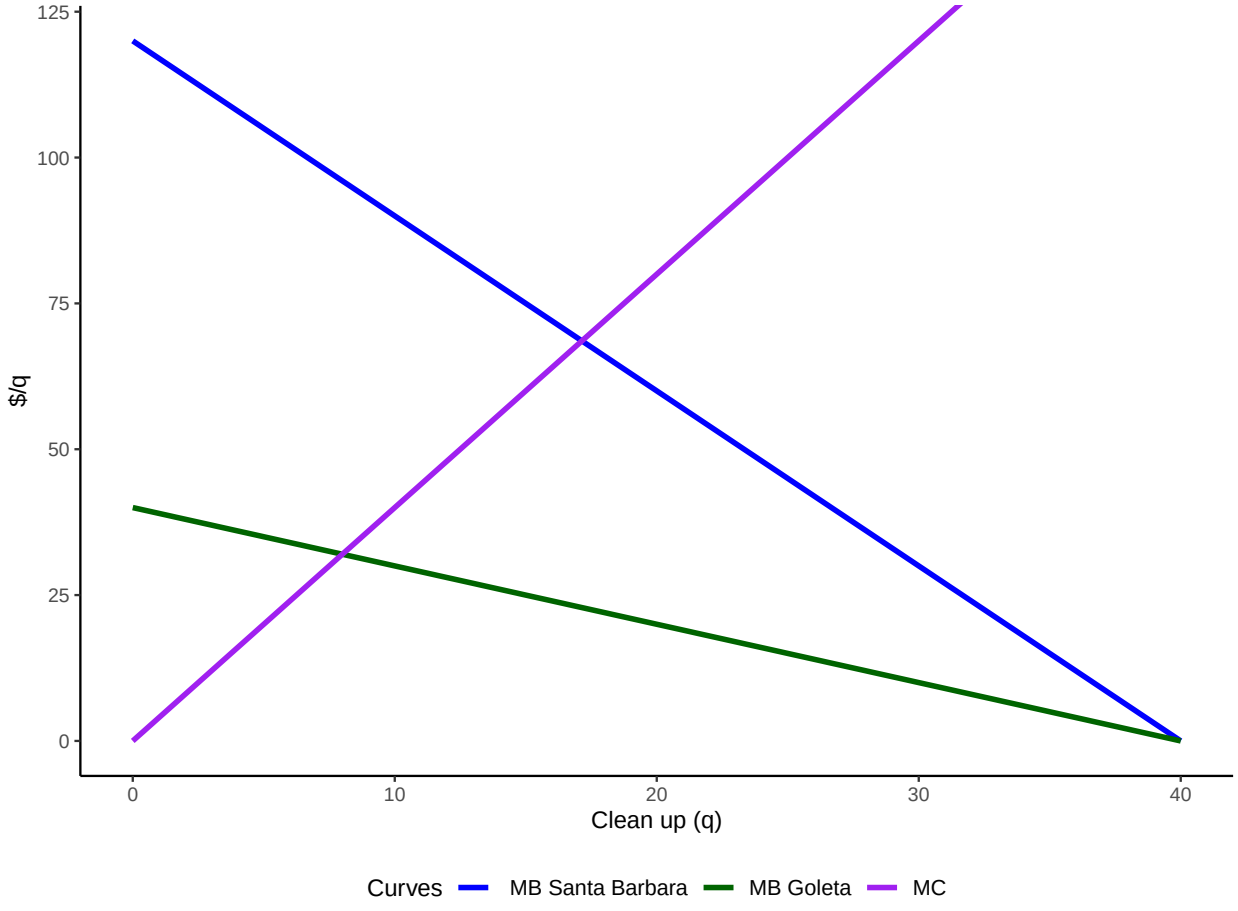
Considering the marginal benefits from the clean beach, the optimal clean up amount (q_e) can be found by:

$$SMB = MC \tag{6}$$

$$\tag{7}$$

where $SMB = MB_{SB} + MB_{GO}$ is the social marginal benefit curve. The curve incorporates the total benefits which would be felt by society as a whole, in this case, it encompasses the benefits of Goleta and Santa Barbara. The efficient amount of cleaning would be $q_e = 20$.

However, given the marginal benefit curves, Goleta will have an incentive to free-ride on Santa Barbara's provision of the public good. To see this, note that in the graph below, Goleta's MB curve always lies below Santa Barbara's. Hence, for any level of cleaning (q), the marginal benefit experienced by Santa Barbara (in monetary terms $, represented in the y-axis) is always higher than for Goleta.



What will be the outcome without coordination? Santa Barbara will provide:

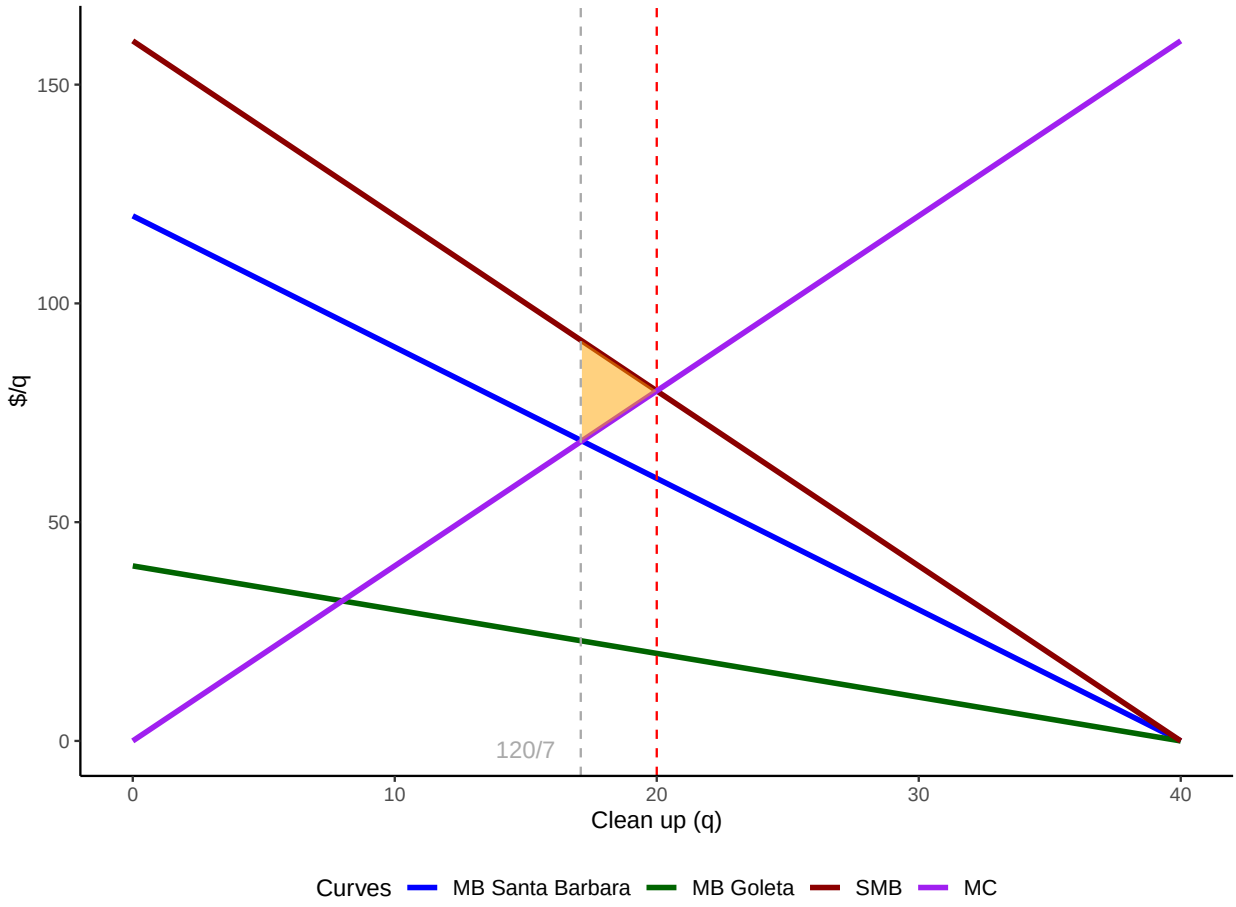
$$MB_{SB} = MC \tag{8}$$
$$120 - 3q = 4q \tag{9}$$
$$7q = 120 \tag{10}$$
$$q_{SB} = \frac{120}{7} \approx 17 \tag{11}$$

And Goleta will free-ride. Why? Note that without coordination Goleta would provide:

$$MB_{GO} = MC \tag{12}$$
$$40 - q = 4q \tag{13}$$
$$5q = 40 \tag{14}$$
$$q = 8 \tag{15}$$

which is far less than how much Santa Barbara would be willing to provide. Since Santa Barbara will provide nearly double of how much as Goleta would be willing, Goleta will free-ride on the beach cleaning provision. However, this provision is below the public-optimal $q_e = 20$.

Why is free riding a problem? Because we will end up in an equilibrium with less welfare. In other words, it will lead to a dead weight loss (DWL). The DWL is represented by the orange triangle below. It represents the loss in surplus (area under SMB and above MC) from having $q = 120/7$ instead of $q_e = 20$.


150
100
50
0
$/q
120/7
0
10
20
30
40
Clean up (q)
Curves
MB Santa Barbara
MB Goleta
SMB
MC