Cowen & Tabarrok, Chapter 2:

1. Consider the following supply curve for oil. Note that MBD stands for “millions of barrels per day,” the usual way people talk about the supply of oil:

   a. Based on the above supply curve, fill in the table below:

<table>
<thead>
<tr>
<th>Price ($/barrel)</th>
<th>Quantity Supplied (MBD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>20</td>
</tr>
<tr>
<td>15</td>
<td>25</td>
</tr>
<tr>
<td>20</td>
<td>30</td>
</tr>
<tr>
<td>30</td>
<td>40</td>
</tr>
<tr>
<td>50</td>
<td>48</td>
</tr>
</tbody>
</table>

   b. If the price for a barrel of oil was $15, how much oil would oil suppliers be willing to supply?

   **25 MBD**

   c. What is the lowest price at which suppliers of oil would be willing to supply 20 MBD?

   **$12 per barrel**
2. Using the following diagram, identify and calculate total producer surplus if the price of oil is $50 per barrel.

![Price of oil per barrel vs. Quantity of oil (MBD)](image)

**Producer surplus:** \(0.5(45)(60)\) = $1,350

3. In Sucrosia, the supply curve for sugar is as follows:

<table>
<thead>
<tr>
<th>Price ($ per 100 pound bag)</th>
<th>Quantity (Bags per month)</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>10,000</td>
</tr>
<tr>
<td>50</td>
<td>15,000</td>
</tr>
<tr>
<td>70</td>
<td>20,000</td>
</tr>
</tbody>
</table>

Under pressure from nutrition activists, the government decides to tax sugar producers with a $5 tax per 100 pound bag. Using the figure above, draw the new supply curve. After the tax is enacted, what price will bring forth quantities of 10,000? 15,000? 20,000? Give your answers in the table below.

**The new supply curve will be $5 higher than the old one.**

<table>
<thead>
<tr>
<th>Price ($ per 100 pound bag)</th>
<th>Quantity (Bags per month)</th>
</tr>
</thead>
<tbody>
<tr>
<td>35</td>
<td>10,000</td>
</tr>
<tr>
<td>55</td>
<td>15,000</td>
</tr>
<tr>
<td>75</td>
<td>20,000</td>
</tr>
</tbody>
</table>
4. What, if any, effects would each of the following events have on the supply curve for tomatoes? What, if any, would the effects of each of these events be on the supplied quantity of tomatoes? Explain why this is not necessarily the same as the effect on the supply curve. Draw graphs to illustrate your reasoning.

a) The fertilizers used to grow tomatoes drop sharply in price

A decrease in the price an input results in a rightward shift of the supply curve. All else held equal, this shift leads to an increase in the equilibrium quantity of tomatoes exchanged.

b) Eating large numbers of tomatoes becomes the latest dietary fad (you are looking at the effects while the fad lasts)

A change in consumer tastes leaves the supply curve unchanged. The change in preference, however, would lead to an increase in demand. All else held equal, this shift of the demand curve results in an increase in the equilibrium quantity of tomatoes exchanged.
c) Widespread use of an improperly tested new pesticide leads to a loss of soil quality in tomato-growing regions

5. Below is the supply schedule showing the opportunity costs of manning an Army. If the Army offers a salary of $8,000 per year, one million civilians will enlist to join the army because the $8,000 salary exceeds the best alternatives available to them for civilian work. The first enlistee has an opportunity cost of $4,000; the one millionth enlistee has an opportunity cost of $8,000. The total cost to society of the one million enlistees is indicated by the area under the supply curve labeled $A$. Society losses the value of the civilian work that would have been provided by these one million soldiers had an Army not been necessary for the national defense of the country.
a. **All-Volunteer Army.** Calculate the cost to society of providing a three million man Army if society chooses to rely strictly on volunteers.

This is given by the areas A, B, and C. The value of the civilian services lost is a trapezoid. The area of the trapezoid is given by \( \frac{1}{2} h(b_1 + b_2) \), where \( h \) is the height and \( b_1 \) is the top and \( b_2 \) is the bottom. \( A+B+C = \frac{1}{2}(3)(4 + 16) = \$30 \text{ billion} \).

b. What does it cost taxpayers to provide the all-volunteer force?

The taxpayers must pay the wage bill for the all-volunteer army. The military must pay a wage of $16,000 per soldier to induce three million civilians to enlist. The wage bill to the taxpayers is $16,000×3 \text{ million} = \$48 \text{ billion}.

c. **Draftees.** Calculate the cost to society of providing a three million man Army if society institutes a draft, and sets the pay at $8,000 for both enlistees and draftees. Assume that the two million draftees are selected randomly from the pool of the four million civilians who do not enlist.

Since one million civilians enlist at the wage of $8,000 the cost to society of the lost services of enlistees is given by area \( A = \frac{1}{2} (1)(4 + 8) = \$6 \text{ billion} \).

The lost services of the two million draftees will be one-half of the area \( B+C+D+E \). Since draftees are selected randomly, about one-half of the draftees will have opportunity costs that exceed $16,000. The area \( B+C+D+E = \frac{1}{2}(5-1)(8 + 24) = \$64 \text{ billion} \). One-half of this—the cost to society of the 2 million draftees—is \$32 \text{ billion}.

The total cost of the three million man army is \$38 (= 6 + 32) \text{ billion}.

d. What does it cost taxpayers to provide a mixed force of enlistees and draftees?

The taxpayers must pay the wage bill for the volunteers and draftees. The military pays a wage of $8,000 per soldier. The wage bill to the taxpayers is \$24 \text{ billion} (half that of the all-volunteer army!).

The conscripted army costs the taxpayers less, but it costs society more than the all-volunteer army. So who bears this cost? The conscripts, by and large, bear most of the cost. A civilian who would not have enlisted for a salary less than $22,000 but is drafted and paid $8,000 is essentially taxed $14,000 for the privilege of serving his country.
MOUSE WISDOM AND DRAFT ANIMALS

Adam and Karl are two thoughtful mice who live somewhere in my office. Recently, they discussed the military draft. This was prompted by the announcement of the Mouse Chief that all mice 19 and 20 months old would have to register with the Rodent Recruitment Service.

"I favor a mouse draft," Karl exclaimed. "It's not just that young mice — like young mice before them — have an obligation to defend their fellow mice, but the draft is also a cheaper way to raise an army."

Adam replied, "The draft is not necessarily cheaper."

"Nonsense," snapped Karl. "Less money would be spent on any army that is drafted, because we could pay them a lower wage."

"That's right," Adam agreed.

"You admit I am right!" exclaimed Karl.

"No, not really," cautioned Adam. "It is true that less money would be spent on an army of draftees than one of volunteers, but it is not true that this army of draftees is less costly."

"Adam, that Tillamook you just ate is causing you to hallucinate," said Karl gently. "How can a drafted army, which is paid lower wages, not be cheaper?"

Adam slowly chewed another bite of cheese, licked his whiskers, and replied: "It's quite simple. The money spent on a drafted army does not measure the real cost of using mouse time there. The real cost of a mouse's time in the military is the value of the civilian job sacrificed. What do we have to forego in order to have an additional mouse soldier? Say Fred Fieldmouse has a civilian job making this delicious cheese, where he earns $10,000 a year. The real cost of his spending a year in the army would be $10,000, the amount he would earn producing cheese. Even if he had no preference in cheesemaking or soldiering, the army would have to pay him at least $10,000 a year to induce him to stop making cheese and join the army. If the army has to draft him because he refuses to join voluntarily, it is because the army does not offer sufficient wages to compensate him for his lost civilian job."

Karl began to see the light. "You mean," he said, "if Fred were drafted and paid, say, $6,000, the real cost of using a year of his time is still $10,000?"

"Right," said Adam. "The alternative cost of the additional service-mouse is the $10,000 cheesemaker we give up, irrespective of how much the recruit is paid. We can't avoid that cost."

"But note how the cost is borne when we have a draft," Adam continued. "If we draft Fred, taxpayers would compensate him for only $6,000 of the cost. The other $4,000, not compensated, is a tax imposed on him by the draft. The draft is a way to hide the real cost of an army, by shifting much of that cost onto the recruits. Instead of having taxpayers assume the full cost of paying enough to induce people to move into the armed forces, we force draftees to bear an enormous part of the cost as a labor tax."

"But I think that young mice have an obligation to defend their society," added Karl.

"I agree," said Adam, "and I am appalled by the egocentric boorishness of parasitic, loud-mouthed young mice who flaunt their unwillingness to defend their country under any circumstances. But a labor tax on draftees is not the only way to meet our military necessities."