



## Worksheet – Per-unit tax

**Related news article:** [Northbrook approves 10-cent tax on single-use bags](#) (Daily Herald, February 15, 2023)

**Summary:** This worksheet could be used for in-class or homework practice. Students will be asked to read a short article about the introduction of a per-unit tax on the consumers of single-use bags. Then, students will be asked to analyze the effect of this tax on the price of single-use bags, the equilibrium quantity, consumer and producer surplus. They will also have to graphically show these effects. Students will also be encouraged to discuss the reasons for the introduction of the tax. **Answers are provided at the end of this document.**

### Learning objectives:

At the end of this worksheet, students will be able to:

- o Analyze the effect of the introduction of a per-unit tax on the consumers of single-use bags;
- o Graphically show the effect of the introduction of a per-unit tax on consumers (shift in demand), the area that represents the tax revenue, and the deadweight loss;
- o Understand that consumers and producers share the tax burden regardless of whether the tax has been imposed on the consumers or the producers;
- o Apply the supply and demand model to analyze the effect of an increase in the price of single-use bags on the market for a substitute.
- o Recognize analogies.

**Economics concepts:** Per-unit tax, Tax revenue, Deadweight loss, Substitutes, Elasticity

### Suggested excerpts:

“...Northbrook trustees have approved an ordinance taxing single-use bags.”

“Board members voted 5-0 with one member absent on Feb. 7 to amend the village [Northbrook] code establishing a 10-cent tax on carryout bags, to be imposed on customers. The proceeds will be split between retailers and the village's Sustainability Fund.”

“Tessa Murray, Northbrook's sustainability coordinator, said the tax is "meant to discourage use of disposable bags due to their negative impact on the environment.””

““This single-use bag tax is an important next step in the Village of Northbrook's implementation of its Climate Action Plan,” said Trustee Heather Ross...”

“Adopted in August 2021, the Climate Action Plan includes dozens of strategies over eight different sectors with the goal of greenhouse gas reduction, climate adaptation and overall sustainability.”

“Under the Waste Management section, the phaseout of single-use products such as bags is the first action toward the goal of decreasing municipal solid waste by 5% by the year 2030.”

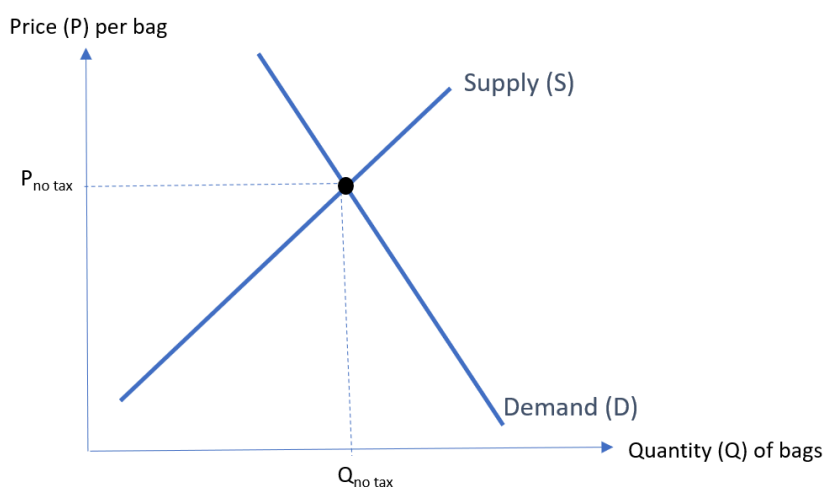
““As one of the top action items identified in the plan,” Ross said, “the single-use bag tax aims to change consumer behavior and encourage the use of reusable shopping bags to reduce litter, environmental impacts, and recycling costs of single-use bags,” Ross said.”

## Questions

1. According to the article, the city of Northbrook introduced a 10-cent tax on single-use bags. The tax was imposed on consumers. Which of the following shifts was a result of this tax?

- Demand shifted to the right.
- Demand shifted to the left.
- Supply shifted to the right.
- Supply shifted to the left.

2. The following graph shows the supply and demand curves for single-use bags in Northbrook. Show the change you identified in Question 1 on the graph below.



- Use the graph in Question 2 to shade the area that represents the tax revenue the government collects from the tax on single-use bags.
- Use the graph in Question 2 to shade the area that represents the deadweight loss generated after the introduction of the tax on single-use bags.
- Which of the following is a result of the introduction of a 10-cent tax on single-use bags?
  - The price consumers pay per single-use bag before and after the introduction of the tax is the same.
  - The tax does not generate a deadweight loss.
  - The sellers of single-use bags pay part of the tax.
  - Consumer surplus decreases while producer surplus remains unchanged after the introduction of the tax.
- What was the purpose of the tax imposed on single-use, disposable bags?

- a. To decrease solid waste.
  - b. To reduce recycling costs of disposable bags.
  - c. To alleviate the adverse effect of the use of disposable bags on the environment.
  - d. All of the above.
7. The article states that single-use, disposable bags have a “negative impact on the environment.” The cost imposed on the society that the consumers of these bags do not take into account when they make market decisions is called:
- a. Opportunity cost.
  - b. External benefit.
  - c. Marginal cost.
  - d. External cost.
8. Which of the following pairs of goods are related in the same way as single-use bags are to reusable shopping bags?
- a. Tomatos and pesto sauce.
  - b. Fabric and tablecloth.
  - c. Wireless earbuds and wired headphones.
  - d. Wood and wooden desk.
9. If the price of single-use bags increases, what would happen in the market for reusable shopping bags?
- a. Demand shifts to the right, leading to a higher equilibrium price and higher equilibrium quantity of reusable shopping bags.
  - b. Demand shifts to the left, leading to a lower equilibrium price and lower equilibrium quantity of reusable shopping bags.
  - c. Supply shifts to the right, leading to a lower equilibrium price and higher equilibrium quantity of reusable shopping bags.
  - d. Supply shifts to the left, leading to a higher equilibrium price and lower equilibrium quantity of reusable shopping bags.
10. Do you think that a 10-cent tax levied on single-use bags would provide an incentive to “enough” consumers to switch to reusable shopping bags and “sufficiently” reduce litter and alleviate environmental concerns?

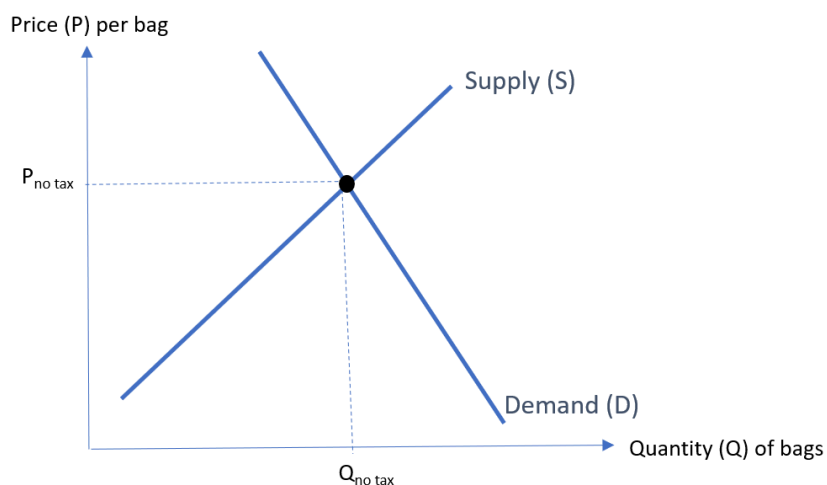
## Answer Key

1. According to the article, the city of Northbrook introduced a 10-cent tax on single-use bags. The tax was imposed on consumers. Which of the following shifts was a result of this tax?

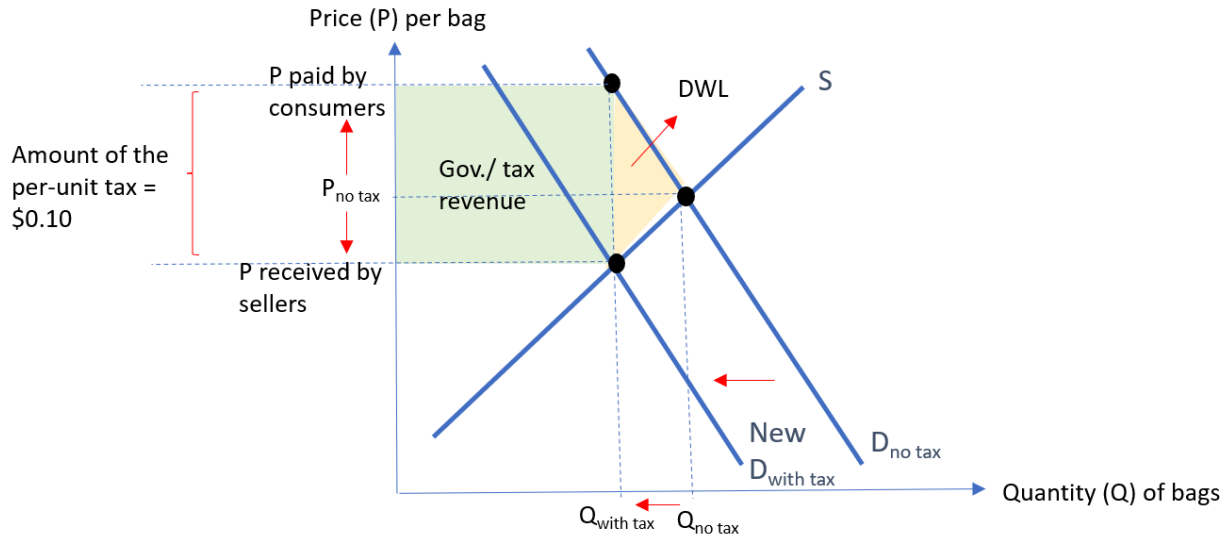
- a. Demand shifted to the right.
- b. Demand shifted to the left.
- c. Supply shifted to the right.
- d. Supply shifted to the left.

**Answer: B. The tax was imposed on the consumers, so the demand curve shifted. A tax discouraged consumption of the single-use bags, so demand decreased, i.e., the demand curve shifted to the left.**

2. The following graph shows the supply and demand curves for single-use bags in Northbrook. Show the change you identified in Question 1 on the graph below.



**Answer: The following graph shows the shift of the demand curve to the left, the price paid by consumers and that received by sellers after the introduction of the tax. The government (tax) revenue and the deadweight loss have been shown too.**



3. Use the graph in Question 2 to shade the area that represents the tax revenue the government collects from the tax on single-use bags.

**Answer: See the area shaded in green in the answer of Question 2.**

4. Use the graph in Question 2 to shade the area that represents the deadweight loss generated after the introduction of the tax on single-use bags.

**Answer: See the area shaded in orange in the answer of Question 2.**

5. Which of the following is a result of the introduction of a 10-cent tax on single-use bags?
- The price consumers pay per single-use bag before and after the introduction of the tax is the same.
  - The tax does not generate a deadweight loss.
  - The sellers of single-use bags pay part of the tax.
  - Consumer surplus decreases while producer surplus remains unchanged after the introduction of the tax.

**Answer: C. Consumers and producers share the tax burden. After the introduction of the tax, consumers pay more, sellers receive a lower price, both consumer and producer surplus decline, and there is a deadweight loss.**

6. What was the purpose of the tax imposed on single-use, disposable bags?
- To decrease solid waste.

- b. To reduce recycling costs of disposable bags.
- c. To alleviate the adverse effect of the use of disposable bags on the environment.
- d. All of the above.

**Answer: D.**

7. The article states that single-use, disposable bags have a “negative impact on the environment.” The cost imposed on the society that the consumers of these bags do not take into account when they make market decisions is called:

- a. Opportunity cost.
- b. External benefit.
- c. Marginal cost.
- d. External cost.

**Answer: D.**

8. Which of the following pairs of goods are related in the same way as single-use bags are to reusable shopping bags?

- a. Tomatos and pesto sauce.
- b. Fabric and tablecloth.
- c. Wireless earbuds and wired headphones.
- d. Wood and wooden desk.

**Answer: C. Single-use bags and reusable shopping bags are substitutes. Similarly, wireless earbuds and wired headphones are substitutes. In contrast, tomatos and pesto sauce are complements. Fabric is an input for a tablecloth, and wood is an input for a wooden desk.**

9. If the price of single-use bags increases, what would happen in the market for reusable shopping bags?

- a. Demand shifts to the right, leading to a higher equilibrium price and higher equilibrium quantity of reusable shopping bags.
- b. Demand shifts to the left, leading to a lower equilibrium price and lower equilibrium quantity of reusable shopping bags.
- c. Supply shifts to the right, leading to a lower equilibrium price and higher equilibrium quantity of reusable shopping bags.
- d. Supply shifts to the left, leading to a higher equilibrium price and lower equilibrium quantity of reusable shopping bags.

**Answer: A. Single-use bags and reusable shopping bags are substitutes. If single-use bags become more expensive, the demand for reusable shopping bags would increase. Graphically, the demand curve for reusable shopping bags would shift to the right, leading to a higher equilibrium price and higher equilibrium quantity of reusable shopping bags.**

10. Do you think that a 10-cent tax levied on single-use bags would provide an incentive to “enough” consumers to switch to reusable shopping bags and “sufficiently” reduce litter and alleviate environmental concerns?

**Answer: Answers will vary. Answers might depend on what students consider to be a “sufficient” number of consumers and “sufficient” litter reduction and environmental concerns. They might explain that a tax imposed on consumers of single-use bags would reduce the demand for the good. However, they might also argue that because bags represent a small part of consumers’ budget, consumers might not respond “much” to the price change.**