AP Micro Lecture Guide: The Deadweight Loss Plan

Lesson Author

Mike Kaiman, Federal Reserve Bank of St. Louis

Standards and Benchmarks (see pages 11-12)

Lesson Description

Deadweight loss is the value of foregone mutually beneficial transactions in a market. This loss can occur as a result of government intervention, market structure, externality, or international trade. This lecture guide allows teachers to walk students step-by-step through several examples of where deadweight loss exists in a market and how it affects producers and consumers. Students will practice graphing and calculating the consequences of deadweight loss in a monopoly market due to (1) a per-unit tax instituted by a government and (2) an opening of a domestic market to international trade both before and after a tariff regulation. Finally, students will be assessed on the concepts and skills with additional graphing and calculation practice.

Grade Level

9-12, College

Concepts

Allocative efficiency

Consumer surplus

Deadweight loss

Producer surplus

Socially optimal quantity

Total economic surplus

Objectives

Students will be able to

- define deadweight loss, consumer surplus, producer surplus, and total economic surplus;
- draw and accurately label efficient and inefficient market graphs; and

- calculate deadweight loss, consumer surplus, producer surplus, and total economic surplus in a market scenario.

Compelling Question

What is deadweight loss in an inefficient market, and how do externalities, government interventions, and market power affect producers and consumers?

Time Required

50-60 minutes

Materials

- PowerPoint slide deck
- Handouts 1 and 2, one copy of each for each student
- Handout 2 Answer Key, one copy for the instructor

Procedure

1. Ask students, "What does it mean that a competitive market is efficient?" (*Answers will vary.*) Review that a perfectly competitive market is an allocatively efficient market because resources are efficiently and optimally allocated; that is, goods are produced at the level where marginal cost (MC) equals marginal benefit (MB), resulting in maximization of **consumer surplus** and **producer surplus**.

2. Display slide 2 and ask students, "If cookie bakeries are willing to produce 25,000 cookies and sell each cookie for $1.00, and if consumers are willing to purchase 25,000 cookies and pay $1.00 per cookie, is the market efficient?" (*This market is efficient.*)

3. Display slide 3. Highlight that when a competitive market is in equilibrium, both consumer surplus and producer surplus are maximized and the market is efficient. In other words, when producers' marginal costs intersect with consumers' marginal benefits it is known as **allocative efficiency**. Discuss the following:

   - What is the market structure called when a market is allocatively efficient like the one illustrated on slide 3? (*Answers will vary, but guide students to conclude that this is a perfectly competitive market.*)

4. Remind students that a perfectly competitive market is not the only market structure and that sometimes a single firm can control an entire market, which is known as a monopoly. Display slide 4. Explain that in a monopoly a single firm sets a price, so not only can it charge a higher price than it could in a perfect competition, but it will produce less than what consumers demand because of profit maximization rules.

5. Display slide 5. Ask students, "What would happen if there were only one cookie baker in the market that has complete market power?" Instruct students to first identify the original market equilibrium where supply and demand intersect. (*25,000 cookies produced at $1.00*) Then advance the animation and review what the profit-maximizing quantity produced is for the monopoly baker and what price that firm will set. (*16,667 cookies produced at a price of $1.33 per unit*) Discuss the following:
    - How many fewer cookies are being produced? (*8,333*) Advance the slide animation to review with students.
    - Is the market with this monopoly efficient? (*This market is not efficient.*) Advance the slide animation again to show that because the marginal benefit for consumers is greater than the marginal cost to the monopoly at 16,667 cookies produced, it is now an inefficient market.
    - In this inefficient market, what will happen to consumer surplus and producer surplus? (*Answers will vary.*) Advance the animation on slide 5 again to show that consumer surplus decreases and producer surplus increases.

6. Explain that there is now an area of **deadweight loss** created that is equal to the lost consumer surplus and producer surplus because the decrease in production has moved the market away from its allocative efficiency. Advance the animation on slide 5 to identify the newly shaded area of deadweight loss.

7. Display slide 6. Explain that students will now identify and calculate deadweight loss when it occurs in an inefficient market for a variety of reasons. The next two situations will show the effect of government interventions—price ceilings and price floors—and how deadweight loss is created.

8. Display slide 7. Explain that this first instance of deadweight loss comes from a government-mandated price ceiling. Focus students' attention on the first situation. Explain that the market for cookies is efficient and in equilibrium. At a market price of $1.00 per cookie, 25,000 cookies are produced and consumed.

9. Advance the animation on slide7. Explain that a government enacts a law that creates a price ceiling of $0.60 for one cookie. Ask students, "With this intervention, what will happen to the number of cookies supplied in the market?" (*The number of cookies supplied would decrease.*) Advance the animation again to show that only 15,000 cookies are supplied at that price ceiling. Discuss the following:
    - If there are only 15,000 cookies available, but consumer demand hasn't changed, how many cookies are not being produced? (*Under the original equilibrium, 25,000 cookies were produced and consumed, which means now there are 10,000 cookies and consumers that are not participating in this market.*)

10. Advance the animation on slide 7 to show that the area between the previous number of cookies produced (25,000) and the new quantity produced (15,000) creates a deadweight loss zone.

11. Continue by asking students, "What happens to consumer surplus and producer surplus if deadweight loss exists because of a price ceiling?" (*Answers will vary.*) Explain that both consumer surplus and producer surplus are consequently reduced. Advance the animation again on slide 7 to show the new consumer surplus and producer surplus.

12. Display slide 8 and explain that, instead of setting a price ceiling, the government passes a law creating a price floor of $1.60 per cookie. In this situation, while suppliers would want to produce more than the original 25,000 cookies because of the higher price, consumers would demand fewer cookies.

13. Advance the animation to illustrate that because of the artificially high price, producers are encouraged to produce 40,000 cookies while consumers will only purchase 10,000 cookies. As a result, deadweight loss now exists for that difference of 15,000 cookies from before the government intervention. Advance the animation again to show that consumer surplus is dramatically reduced.

14. Display slide 9. Explain that deadweight loss can also occur when the production or the consumption of the good generates externalities in the market. (NOTE: If teachers or students need deeper background on externalities in general, please refer to: https://www.federalreserveeducation.org/teaching-resources/economics/market-failure/externalities.)

15. Display slide 10. Take the example of negative externalities in production, where Marginal Social Cost (MSC) > Marginal Private Cost (MPC) and Marginal Social Cost (MSC) > Marginal Social Benefit (MSB) so that there is market equilibrium. Identify the market equilibrium quantity and the **socially optimal quantity** of output. In this case, the market equilibrium quantity is greater than the socially optimal quantity; therefore, the market is not socially efficient and there is deadweight loss.

16. Display slide 11 and distribute *Handout 1: Deadweight Loss Graphing Practice*. Tell the class that now, in addition to identifying how deadweight loss is created in various situations, the cost of this inefficiency can also be calculated.

17. Display slide 12 and describe that in the graph shown, Colaville is currently in an allocatively efficient market. Remind students that in equilibrium, the consumer surplus is the triangle formed above the market price along the demand curve and *y*-axis.

18. Advance the animation on slide 12 to show the calculation for the amount of consumer surplus. Advance the animation again and repeat with producer surplus. On Handout 1, students graph this market in the left box of Situation 1 and include labels for consumer surplus and producer surplus.

19. Advance the animation again on slide 12. Tell students that **total economic surplus** is the sum of consumer surplus and producer surplus. After students graph the efficient market, instruct

them to calculate consumer, producer, and total economic surpluses by finding the area of each triangle. (Remind students that the formula for finding the area of a triangle is half the base times height.) Show all answers on slide 12 and check students' work.

20. Display slide 13 and now explain that Colaville's government chooses to impose a $2.00 per-unit tax on soda to reduce the health consequences of drinking too many sugary beverages. Assume that the tax will be shared equally by consumers and producers. Discuss the following:
    - What is the first consequence of this action on the market? (*The supply of soda will shift to the left.*)

21. Advance the animation on slide 13. For the right graph, instruct students to draw the shifted supply curve and label it "supply + tax." Remind them that as the tax is being shared equally between consumers and producers, the new market price will be $4.00. (For simplicity, instruct students to also label the new equilibrium quantity 50,000 gallons on the *x*-axis.)

22. Instruct students to identify and calculate the new consumer surplus after the tax. (*$50,000*) Advance the animation on slide 13 to check their math. Repeat the process and discuss as you click through the animation for producer surplus (*$50,000*), tax revenue (*$100,000*), and deadweight loss (*$25,000*).

23. Display slide 14. Discuss how the total economic surplus changed after the tax was implemented. The table on the slide will help show the impact of the per-unit tax. Discuss the following:
    - Is the government's revenue generated by the tax $100,000? (*The government does generate $100,000 in revenue.*)

24. Discuss what might explain the difference in loss of total economic surplus and the tax revenue generated. Lead the class to see that the other $25,000 lost in total economic surplus is the deadweight loss of this market after government intervention. (NOTE: Some students may have noticed and already found the area of the triangle created.)

25. Conclude this section by explaining that wherever deadweight loss exists, the triangle that is formed represents the direction in which the competitive market would like to go if no intervention existed. In this case, the deadweight loss is pointing toward more quantity produced.

26. Display slide 15. For the final deadweight loss example, students will examine and graph the impact of international trade and tariffs.

27. Display slide 16 and explain to students this is the domestic market for jeans. Note that consumer surplus and producer surplus are already shaded and calculated. Tell students they do <u>not</u> have to copy this graph on their handout.

28. Display slide 17. Tell students to assume the domestic economy opens itself up and begins trade with another country that imports jeans. Explain that the world price is lower than the equilibrium price in the previously isolated market. Instruct students to label the world price (WP) after trade on the left graph of Situation 2 on their handout.

29. Display slide 18. Ask students, "Do you believe consumer surplus increases or decreases with world trade?" (*Answers will vary.*) Advance the animation showing that consumer surplus increases. Instruct students to make the appropriate calculation to determine the new consumer surplus. (*$320,000*)

30. Ask students, "Do you believe producer surplus increases or decreases with world trade?" (*Answers will vary.*) Advance the animation showing that producer surplus decreases. Repeat the calculation process and check students' work. (*$20,000*)

31. Ask students, "Is there a deadweight loss in this market with world trade?" (*Answers will vary.*) Explain that there is *no* deadweight loss in this situation and advance the animation on slide 18. Instruct students to shade in and label consumer surplus and producer surplus on the left graph of Situation 2 on their handout.

32. Discuss the following:

    - Do consumers or producers benefit from world trade? Why? (*Consumers benefit from world trade because the price has significantly lowered, allowing more consumption of jeans. Producers are negatively affected because, with the lower price from trade, their producer surplus is significantly reduced from the original equilibrium.*)
    - What happened to total economic surplus after trade? (*It increased.*)

33. Explain that those domestic jeans manufacturers, harmed by the added global trade, convince the government to place a tariff on imported jeans. Display slide 19 and advance the animation to show the impact of the tariff. Instruct students to shade the tariff revenue on the right graph of Situation 2 on their handout and to calculate the total dollars collected by the tariff and the amount of deadweight loss. Discuss the following as you click through the animations on slide 19:

    - Does consumer surplus increase, decrease, or remain the same after the tariff? (*It decreases to $281,250 from $320,000.*)
    - Does the producer surplus increase, decrease, or remain the same after the tariff? (*It increases to $31,250 from $20,000.*)
    - Does deadweight loss exist after the government intervention of the tariff? (*Yes. In addition to the tariff raising $25,000 for the government, there is a deadweight loss of $2,500.*)

34. Emphasize that there are two deadweight loss areas in effect because, prior to the installation of the tariff, consumers could purchase jeans at the $20 price with the trade level, but now they cannot because of the government intervention. Also highlight that producer surplus did increase because of the tariff, as domestically produced jeans are exempt from that tax.

Closure

35. Discuss the following main points of the lesson:

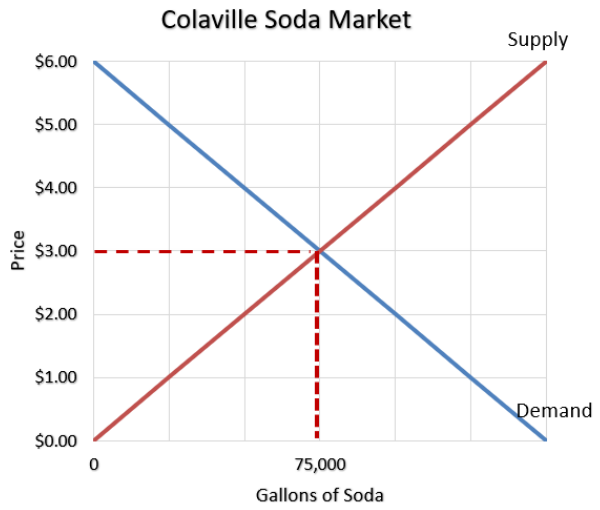
    - What is the definition of deadweight loss? (*It is the net loss of consumer surplus and producer surplus.*)
    - On a graph, the triangle of deadweight loss will always point to what? (*Deadweight loss always points in the direction to which the market would like to go if no barriers or inefficiencies exist.*)
    - When considering world trade and potential government interventions like tariffs, why are there two areas of deadweight loss? (*The tariff reduces the number of transactions that consumers could have made with the lower price without the trade barrier. When calculating deadweight loss, it is important to account for the entire area lost with a government intervention.*)

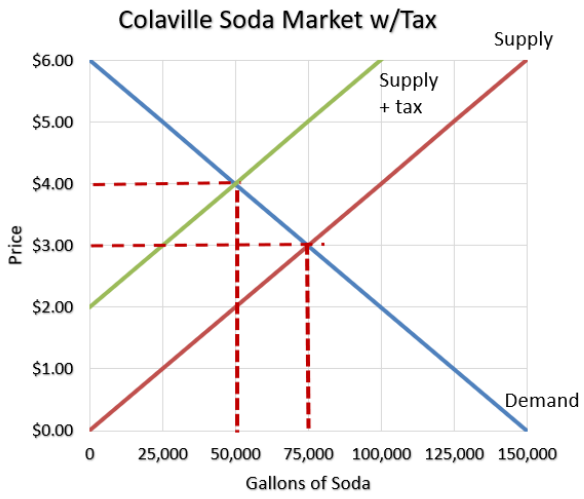
Assessment

36. Distribute a copy of *Handout 2: Deadweight Loss Graphing Assessment*. Students are to accurately shade in the labeled prompts from the graphs provided and calculate the various consumer surplus, producer surplus, and deadweight loss. Review students' work with the *Handout 2: Deadweight Loss Graphing Assessment—Answer Key*.

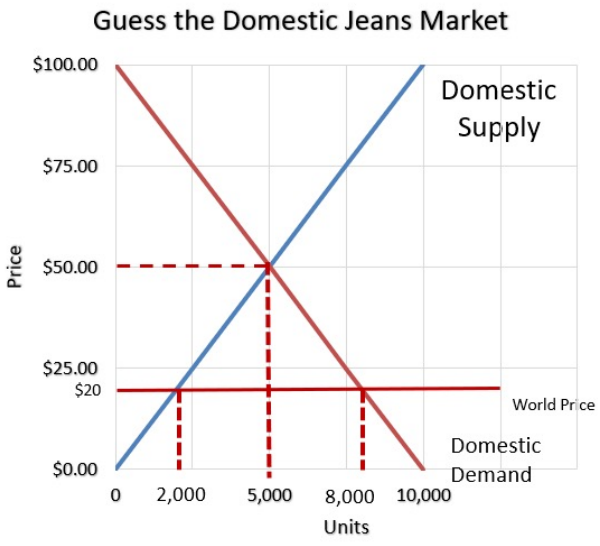
Handout 1: Deadweight Loss Graphing Practice

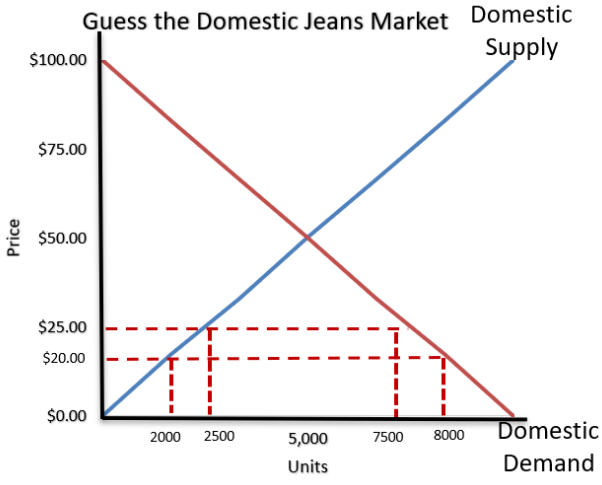
Situation 1: Government Intervention in Colaville





Situation 2: International Trade in Jeans Market

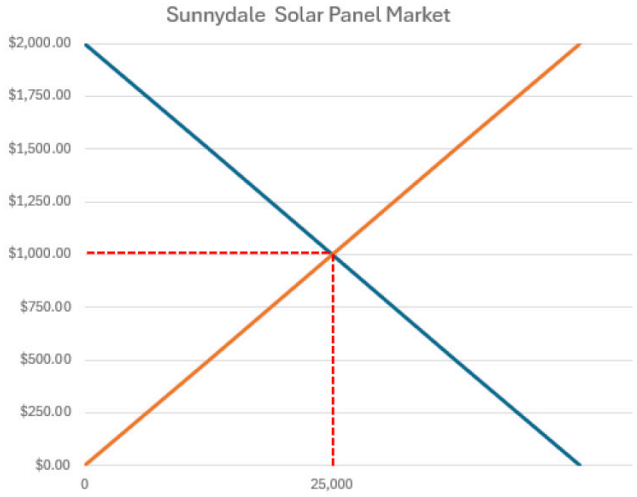




Handout 2: Deadweight Loss Graphing Assessment

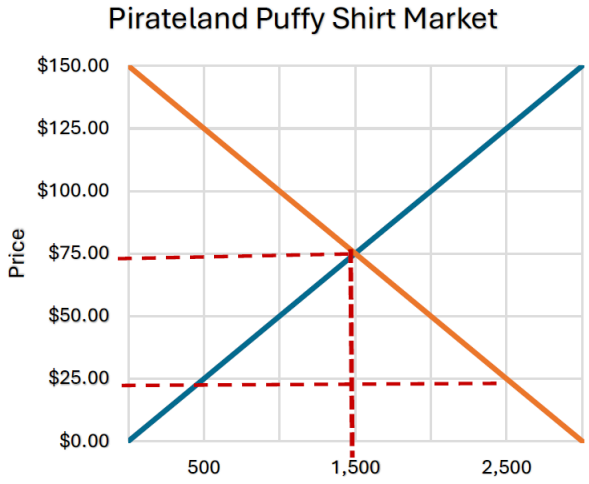
Problem 1

Consider the supply and demand graph below showing a market for solar panels in equilibrium where 25,000 panels are demanded and the market-clearing price is $1,000. The government of Sunnydale would like to increase the supply where the new equilibrium would be 30,000 panels demanded at a market-clearing price of $750. To do this, it offers a subsidy of $500 per panel. Draw this change on the original graph, labeling the new supply curve S_1 and noting the new equilibrium price and quantity. Shade in the area for deadweight loss after the government intervention.



Problem 2

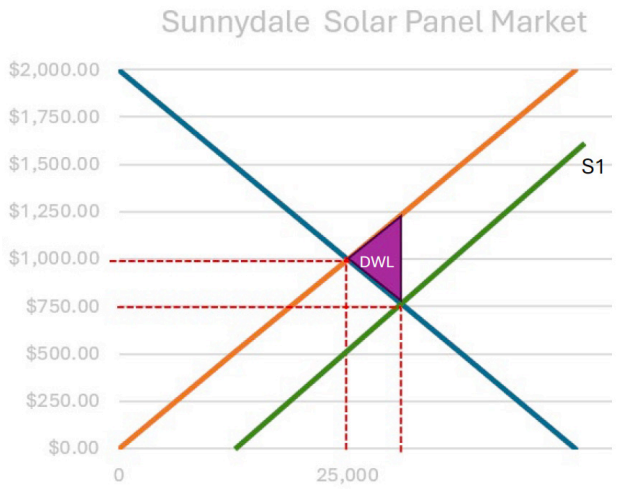
The graph below shows Pirateland's domestic market for puffy shirts where the original equilibrium was 1,500 shirts at a market-clearing price of $75, but now it has recently opened to international trade at the world price of $25, allowing consumers to consume 2,500 shirts at $25. The government of Pirateland enacted a $25 tariff to protect domestic production. Accurately label the following: the price with the tariff, consumer surplus, producer surplus, the world price for puffy shirts with trade, the area of tariff revenue, and deadweight loss.



Handout 2: Deadweight Loss Graphing Assessment—Answer Key

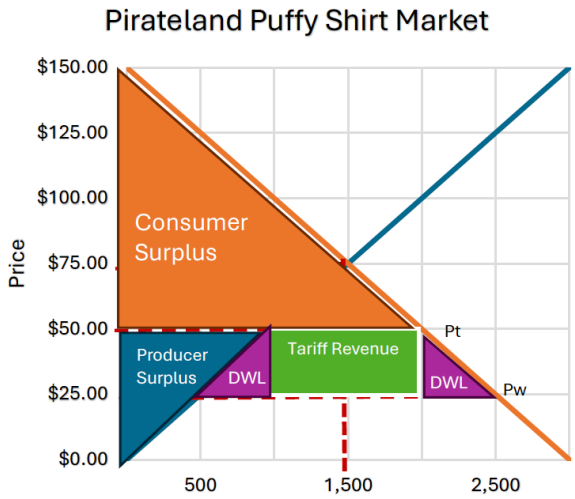
Problem 1

Consider the supply and demand graph below showing a market for solar panels in equilibrium where 25,000 panels are demanded and the market-clearing price is $1,000. The government of Sunnydale would like to increase the supply where the new equilibrium would be 30,000 panels demanded at a market-clearing price of $750. To do this, it offers a subsidy of $500 per panel. Draw this change on the original graph, labeling the new supply curve S_1 and noting the new equilibrium price and quantity. Shade in the area for deadweight loss after the government intervention.



Problem 2

The graph below shows Pirateland's domestic market for puffy shirts where the original equilibrium was 1,500 shirts at a market-clearing price of $75, but now it has recently opened to international trade at the world price of $25, allowing consumers to consume 2,500 shirts at $25. The government of Pirateland enacted a $25 tariff to protect domestic production. Accurately label the following: the price with the tariff, consumer surplus, producer surplus, the world price for puffy shirts with trade, the area of tariff revenue, and deadweight loss.



Standards and Benchmarks

AP Microeconomics Curriculum Alignment

AP Economic Skills

- Principles and Models 1B: Identify an economic concept, principle or model illustrated by an example.
- Interpretation 2A: Using economic concepts, principles, or models, explain how a specific economic outcome occurs or what action should be taken in order to achieve a specific economic outcome.
- Interpretation 2.C: Interpret a specific economic outcome using quantitative data or calculations.
- Manipulation 3.A: Determine the outcome of an economic situation using economic concepts, principles, or models.
- Manipulation 3.C: Determine the effect(s) of a change in an economic situation using quantitative data or calculations.
- Graphing and Visuals 4A: Draw an accurately labeled graph or visual to represent an economic model or market.
- Graphic and Visuals 4B: Demonstrate your understanding of a specific economic situation on an accurately labeled graph or visual.
- Graphic and Visuals 4C: Demonstrate the effect of a change in an economic situation on an accurately labeled graph or visual.

Unit Alignment

- Topic 2.8 The Effects of Government Intervention in Markets – Learning Objective POL-1.A.b Explain (using graphs where appropriate) how government policies alter consumer and producer behaviors that influence incentives and therefore affect outcomes
- Topic 2.8 The Effects of Government Intervention in Markets – Learning Objective POL-1.A.c Calculate (using data from a graph or table where appropriate) changes in market outcomes resulting from government policies.
- Topic 2.9 International Trade and Public Policy – Learning Objective POL-1.B.b. Explain (using graphs where appropriate) how markets are affected by public policy related to international trade.
- Topic 2.9 International Trade and Public Policy – Learning Objective POL-1.B.c. Calculate (using data from a graph or table as appropriate) changes in market outcomes resulting from public policy related to international trade.
- TOPIC 4.1 Introduction to Imperfectly Competitive Markets – Learning Objective PRD-3.B a. Define (using graphs where appropriate) the characteristics of imperfectly competitive markets and inefficiency.
- TOPIC 4.2 Monopoly PRD-3.B b. Explain (using graphs where appropriate) equilibrium, firm

decision making, consumer surplus, producer surplus, profit (loss), and deadweight loss in imperfectly competitive markets and why prices in imperfectly competitive markets cannot be relied on to coordinate the actions of all possible market participants and can lead to inefficient outputs. c. Calculate (using data from a graph or table as appropriate) areas of consumer surplus, producer surplus, profit (loss), and deadweight loss in imperfectly competitive markets.

- Topic 6.1 Socially Efficient and Inefficient Market Outcomes – Learning Objective POL-2.C.b Calculate (using graphs where appropriate) the deadweight loss resulting from the production of a non-efficient quantity.
- TOPIC 6.2 Externalities– Learning Objective POL-3.A a. Define externalities. b. Explain (using graphs where appropriate) how in the presence of externalities, private markets do not take into consideration social costs or social benefits.
- TOPIC 6.4 The Effects of Government Intervention in Different Market Structures – Learning Objective POL-4.A a. Define government policy interventions in imperfect markets. b. Explain (using graphs where appropriate) how government policies can alter market outcomes in perfectly and imperfectly competitive markets. c. Calculate (using data from a graph or table as appropriate) changes in market outcomes resulting from government policies in perfectly competitive and imperfectly competitive markets.

Voluntary National Content Standards in Economics Alignment

Standard 16: Role of Government and Market Failure

- **Benchmarks: Grade 12**

    1. Markets do not allocate resources efficiently if: (1) property rights are not clearly defined or enforced; (2) externalities (spillover effects) affecting large numbers of people are associated with the production or consumption of a product; or (3) markets are not competitive.