

Instructor's Manual
for
Price Theory and Applications
by
Steven E. Landsburg

Ninth Edition

Chapter One: Supply, Demand, and Equilibrium

General Discussion

Even after a course in principles, many students are confused about the fundamentals of supply and demand. The most frequent sources of difficulty are:

1) The distinction between demand and quantity demanded. The text places considerable emphasis on this. I always tell my students that a failure to grasp this distinction results in the ability to make arguments that sound very logical but are in fact incorrect; problem 5 at the end of the chapter provides a good example. I have occasionally made it a semester-long assignment to collect examples of such fallacies from the popular press; students with subscriptions to the *New York Times* or the *Wall Street Journal* have ample raw material to work from.

2) A failure to understand that the equilibrating process does not affect the supply and demand curves. The story that we tell about price adjustment following a temporary disequilibrium does not involve any changes in the quantities that people desire to exchange.

3) A failure to understand the role of price adjustment from a point of disequilibrium in the supply and demand model. It is important for students to understand that in this simple model we *always* assume that all markets are in equilibrium. We do tell stories about what we think would happen out of equilibrium (demanders bidding up prices that are too low or suppliers bidding down prices that are too high), but the purpose of these stories is only to motivate the assumption that disequilibrium does not occur. Students sometimes come away with the false impression that the details of price adjustment are an integral part of the model and that the model attempts to describe the path to equilibrium. It is important to be on guard against this.

4) An incorrect approach to comparative statics. Ask students what will happen to the price of bread following a rise in the price of butter. Some will respond that bread is now less desirable, so that people want less of it, which causes the price to be bid down. Others may respond that in that case, less bread will be produced, and this fall in quantity will lead to a higher price. This in turn calls more bread into the market, which causes the price to be bid down, which causes... It is distressingly common for students to begin reasoning in such a circle, stop at an arbitrary point, and think that they have reached a correct conclusion. I stress to my students that when you are asked how the price of bread will react in a given circumstance, it is *never* correct to begin by thinking about the price of bread. One must begin by thinking about the effects on supply and demand (in this case, demand is down and supply is unchanged) and only then infer the effect on price (in this case, price is down).

Many students are bothered by two aspects of this analysis. First, it will seem to them (correctly) that each step in the earlier, convoluted analysis is an important one and that all of these counteracting effects need to be taken into account. They believe (incorrectly) that the supply and demand analysis fails to do this. Second, they simply will not see any reason why the supply and demand analysis should be preferred to the more naive approach.

To address these questions, I sometimes ask students to volunteer the various direct and indirect ways in which the price of bread is affected by an increase in the price of butter. (In fact, this works even better if you use a slightly more complicated example in which both supply and demand change simultaneously.) I list them on the blackboard

(1: lower demand leads to lower price; 2: less bread produced causes price to be bid up, etc.) When the list is long enough, I point out that no one could possibly sort out all of these countervailing effects and come to a conclusion without some additional device. I then point out that supply and demand analysis *is* such a device. The key (and for many students, this must really be stressed) is that in the single shift of the demand curve, we really do take account of all of these effects simultaneously. The fact that *all* of the effects are important is exactly what makes it both *correct* and *necessary* to resort to curve-shifting.

Teaching Suggestions

1) Regarding the seat belt example on pp. 8-9: Someone (I think Armen Alchian) has suggested that the best way to prevent highway deaths might be to require that every car have a spear mounted on the steering wheel aimed directly at the driver's heart. Surely this would reduce the number of accidents. This observation always gets a laugh and makes the point.

2) For another example of how people react to prices in non-market situations: There is apparently a psychology experiment in which subjects are given cups of coffee and told that they can keep the cups. They are not warned that the cups are extremely hot. When the cup is clearly inexpensive, subjects usually drop it; when it is made of fine china, they manage to hang on. I wanted to include this example in the book but was not able to track down a reference on time.

3) Along the same lines, you can cite a paper of Viscusi in the *American Economic Review*: Apparently when child safety caps on medicines are made more difficult to remove, sufficiently many people stop using the caps at all that there is an increase in the number of accidental poisonings.

4) For some students it might be necessary to stress that equilibrium can occur at any price and quantity, and that unusually high or low prices do not imply disequilibrium. For example, if wages are very low and few people are working, some students want to jump to the conclusion that there is disequilibrium in the labor market.

Point out to them that a low demand curve for labor explains the same phenomenon.

5) To drive home the inverse relationship between price and quantity demanded, you might mention that in August, 1990, East German taxicab drivers went on strike to demand *lower* fares.

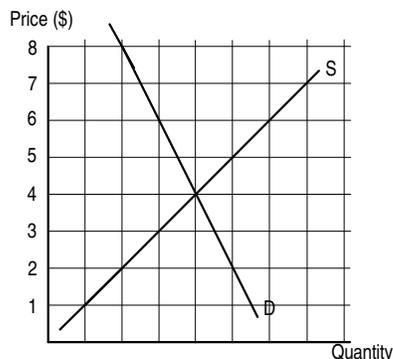
6) Here is a slightly different way to present the material in Exhibit 1–10 (the economic incidence of a tax is independent of its legal incidence). Begin by drawing a graph showing just the original supply and demand curves. Note that ultimately the suppliers must be on their supply curve and the demanders must be on their demand curve; otherwise prices will adjust.

Now note that a 5 cent tax, regardless of its legal nature, drives a 5 cent “wedge” between the suppliers' price and the demanders' price. Take a piece of chalk, hold it vertically, and say that its length is “5 cents.” Then hold the chalk vertically between the supply and demand curves near the price axis, and slowly move it rightward until its top and bottom just touch the demand and supply curves. Conclude that you have found the post-tax equilibrium. Now note that in order to find this equilibrium, you never had to ask what sort of tax was being imposed; thus such information must be irrelevant.

Additional Problems

1. Suppose a new fat substitute comes on the market, making it easy to produce low-calorie hamburgers, french fries, milkshakes, and so forth. *True or False:* The average American will weigh less after this product appears on the market.
2. *True or False:* If 1000 potatoes per day are sold in Des Moines, Iowa, and if a new supplier decides to sell 200 potatoes per day, then 1200 potatoes per day will be sold.
3. *True or False:* If a frost wipes out half the Florida orange crop, then some people who want to buy oranges will not be able to.
4. *True or False:* If we observe a reduction in the number of cars being purchased, then we should expect this change in demand to lead to a fall in price.
5. *True or False:* If the demand for lettuce falls, the price will fall, causing the demand to go back up.
6. *True or False:* According to the laws of supply and demand, when the price of a good rises, less of that good will be sold.
7. *True or False:* In the cities, there are more medical services provided than there are in rural areas. Nevertheless, the price of medical services is higher in the cities. This indicates that our simple “supply and demand” story does not apply to markets for things like medical care.
8. *True or False :* If both the quantity consumed and the price of medical services have risen in the last fifteen years, then the demand curve for medical services must have shifted.
9. A major daily newspaper reports that “although home sales are down, home prices continue to rise, in apparent violation of the law of supply and demand.” Does this observation in fact violate the laws of supply and demand?
10. Ice cream is more expensive in New York than in Iowa, but nevertheless New Yorkers eat more ice cream than Iowans do.
True or False: This is contrary to what a simple “supply and demand” analysis would predict.
11. If the price of ice cream is higher in New York than in Iowa, it must be because the demand for ice cream is higher in New York.
12. In 2003, mad cow disease was first detected in American cattle.
 - a) What do you expect happened to the demand for American beef?
 - b) What do you expect happened to the price of American beef?
 - c) In fact, in the aftermath of the mad cow scare, the price of American beef fell by about 15% and Americans’ beef consumption increased. Can you reconcile this observation with the laws of supply and demand? (Hint: the price of beef is determined in a world market, whereas the demand curve is the sum of American demand and foreign demand.)
13. If the demand curve for avocados is horizontal, then an excise tax on avocados will be passed on entirely to demanders.
14. If the supply curve for corn is perfectly horizontal, how will an excise tax affect the market price of corn? What about a sales tax?
15. If the supply curve for corn is perfectly vertical, how will an excise tax affect the market price of corn? What about a sales tax?

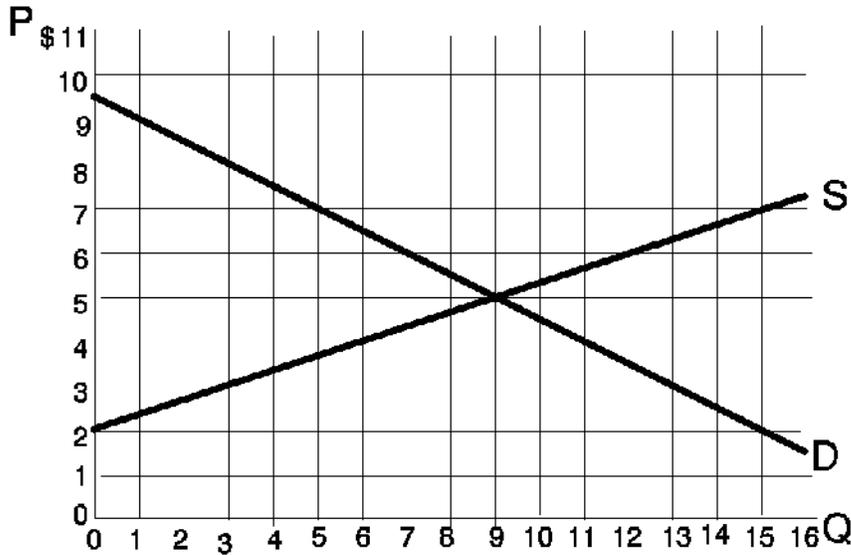
16. The following diagram shows the supply and demand for cupcakes (with quantity measured in dozens).



- a) Suppose the government imposes a new sales tax of \$6 per dozen cupcakes. What will the new price of cupcakes be?
- b) Suppose the government imposes a new excise tax of \$6 per dozen cupcakes. What will the new price of cupcakes be?
17. The demand and supply curves for oranges in Lower Slobbovia are identical to the demand and supply curves for oranges in Upper Slobbovia. One day, the Lower Slobbovian *demand* curve shifts *right* by 150 oranges, while the Upper Slobbovian *supply* curve shifts *left* by 150 oranges.
- a) Use a diagram to illustrate the effect on the price of eggs in Lower Slobbovia. Use a *separate* diagram to illustrate the effect on the price of eggs in Upper Slobbovia.
- b) In which country does the price change by more? Justify your answer by referring to the locations of specific points in your diagrams.
18. The demand and supply curves for widgets in Upper Slobbovia are identical to the demand and supply curves for widgets in Lower Slobbovia. In Upper Slobbovia, every buyer of widgets receives a 5-cent-per-widget subsidy from the government. In Upper Slobbovia, every seller of widgets receives a 5-cent-per-widget subsidy from the government. *True or False:* The price of a widget in Upper Slobbovia is exactly five cents more than the price of a widget in Lower Slobbovia. Use a graph to justify your answer.
19. *True or False:* Some cities raise revenue by levying a tax on employers equal to a certain number of dollars per employee per year. This is a good thing for workers, because workers are not taxed.
20. Coconino County raises revenue through a tax on workers: everybody who has a job in Coconino County must pay a tax of \$25 per year. It has been proposed that this tax be abolished and replaced by a tax on businesses equal to \$25 per employee per year. *True or False:* Although this change sounds like a good thing for workers, it might actually turn out to be bad for them, since the number of jobs would go down.

21. Coconino County raises revenue through a tax on workers: everybody who has a job in Coconino County must pay a tax of \$25 per year. It has been proposed that this tax be abolished and replaced by a tax on businesses equal to \$25 per employee per year. *True or False:* Although this change sounds like a good thing for workers, it might actually turn out to be bad for them, since it could cause wages to fall.
22. The government of Fredonia wants to increase employment and is deciding between two plans. Plan I is to encourage hiring by giving employers \$1 for each hour of labor that they hire. Plan II is to encourage entry into the labor market by giving workers \$1 (in addition to their salary) for every hour that they work.
- Show separately how each plan affects the demand for labor, the supply of labor, and the equilibrium wage rate.
 - Which plan is better for workers? Which plan is better for employers?
 - Referring to your graphs from part a), carefully explain how you were able to draw the conclusion in part b).
23. The government of Coconino County wants to encourage firms to hire more workers. To accomplish this, each firm receives a government subsidy of \$100 per year for each worker on the payroll. To raise the funds for this program, everybody who has a job in Coconino County must pay a \$100 per year “employment tax”. Recently, a city councilman has proposed abolishing the entire program (eliminating both the subsidies to firms and the tax on workers). *True or False:* If the councilman has his way, there will be fewer jobs in Coconino County.
Justify your answer carefully, by looking at the effects on both the supply and demand for labor.
24. Suppose that for some reason, Canadian companies want to sell exactly 100 widgets per year in the U.S., regardless of the price. American widget producers like to produce more widgets when the price goes up.
- In the U.S. widget market, draw the Canadian companies’ supply curve and the overall supply curve.
Now suppose that the U.S. government wants to improve the fortunes of U.S. widget-makers, and is considering two plans to accomplish this. Under Plan A, all Canadian imports will be banned. Under Plan B, the U.S. government will purchase 100 widgets per year from American manufacturers at whatever is the going price.
 - Use supply and demand diagrams to illustrate the effects of these two plans. Which is better for the widget-makers? How do you know?
25. Suppose that the only way to reach a certain restaurant is by train, and the train fare is \$3. One day a law is passed requiring the restaurant owner to provide free transportation to his restaurant, which he does by making an arrangement with the railroad whereby his customers ride free and he pays the \$3 fare per customer directly to the railroad.
- What does this do to the supply curve for restaurant meals?
 - What does this do the demand curve for restaurant meals (*Hint:* It does *not* stay fixed.)
 - What does this do to the price and quantity served of restaurant meals?
 - Of the following, who benefits and who loses as a result of this law: The restaurant owner, the restaurant customers, the railroad?
26. Apples are currently subject to a sales tax of 10 cents per apple. They sell for 25 cents apiece (that is, to buy an apple, the consumer must pay 25 cents plus 10 cents sales tax).

- a) Suppose the sales tax is eliminated. How much can you say about the new price of apples?
 - b) Suppose the sales tax is replaced by an excise tax of 10 cents per apple. How much can you say about the new price of apples?
27. At a price of \$15,000 apiece, Japanese producers are willing to sell any quantity of compact cars that Americans want to buy. *True or False:* An excise tax on Toyotas sold in the United States would be paid entirely by Americans.
28. The following diagram shows the demand and supply for widgets:



- a) Suppose the government imposes a sales tax of \$5 per widget. What is the new price of widgets, and how many are sold? Briefly explain how you got your answer.
 - b) Suppose instead that the government imposes an excise tax of \$5 per widget. What is the new price of widgets, and how many are sold?
 - c) Which tax is better for consumers? Explain your answer in one sentence, based on your answers to parts a) and b).
29. The market for yachts is in equilibrium at a quantity of 500 per year; all 500 are bought by private citizens. Suppose the U.S. government announces that henceforth it will buy 150 yachts per year (regardless of the price).
- a) What happens to the demand for yachts?
 - b) Now how many yachts are bought by private citizens? (Hint: The number bought by private citizens is equal to the total number bought minus the the number bought by the government.) If it is possible to answer this question with an exact number, do so. Otherwise, give a range of numbers (like “between 1,000 and 2,000”). Explain how you got your answer.
30. Suppose that a sales tax would cause the price of an apple to fall by 3 cents. What would be the effect of an excise tax of 10 cents per apple? (Remember that “price” means the pre-tax price.)

31. Suppose that a 40 cent excise tax on apples would lead to a 35 cent increase in the market price of apples. How would a 40 cent sales tax affect the market price of apples?
(The “market price” means the price paid by the buyer to the seller, not including any taxes paid by the buyer.)
32. *True or False:* If the demand curve for rabbit fur is perfectly horizontal, then an excise tax on rabbit fur would be passed on entirely to demanders.
33. Two presidential candidates have offered different economic platforms. Paul Simon, a Democrat, proposes to help the working class by giving each worker an income tax reduction of \$1 for each hour that he works. Art Garfunkel, a Republican, proposes to encourage employment by giving every firm a subsidy of \$1 for each hour of labor that it hires.
- Illustrate the effects of the Simon plan on the demand and supply curves for labor.
 - Illustrate the effects of the Garfunkel plan on the demand and supply curves for labor.
 - True or False:* Workers might actually prefer the Garfunkel plan because it encourages firms to offer more jobs at higher wages. Justify your answer carefully.
34. The government is considering an economic plan under which consumers will pay a new sales tax of 50 cents per gallon of gasoline. The revenue will be used to pay subsidies to gas station owners, who will receive 50 cents from the government for every gallon of gas that they sell.
- How does this plan affect the demand curve for gasoline?
 - How does this plan affect the supply curve for gasoline?
 - True or False:* Although this plan looks like a good thing for gas station owners, it might actually hurt them because demanders will buy less gasoline.
35. Suppose that it costs car manufacturers \$1,000 to install an air bag in a car, and that each customer values an air bag at \$500. A new law requires every car to have an air bag.
- Show how the new law affects the demand and supply curves for cars.
 - What happens to the price of a car after the law is passed? Does it go up or down? Does it change by more or less than \$500? Does it change by more or less than \$1,000?
 - Are consumers made better or worse off by this law? Justify your answer.
36. Suppose that wheat is purchased only by poor people, whose demand for wheat is given by the following chart:

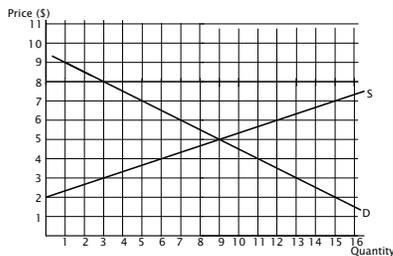
Price	Quantity
\$1	8 bushels
2	7
3	6
4	5

In the spirit of Christmas, a coalition of rich people has decided to buy wheat at the going market price (whatever that price happens to be) and resell it to poor people at half that price. Moreover, they will buy and resell as much wheat as poor people care to purchase.

- List the coordinates of four points on the new demand curve (that is, the rich people’s demand curve) for wheat.
- Suppose that the supply curve for wheat is vertical at a quantity of 7. Do the poor benefit from the generosity of the rich?

- c) Suppose instead that the supply curve for wheat is horizontal at a price of \$2. Do the poor benefit from the generosity of the rich?
37. Apples currently sell for 20 cents apiece. Label each of the following statements *certainly true*, *possibly true* or *certainly false* and justify your answers:
- A 10 cent sales tax would cause the price to fall to 15 cents, and a 10 cent excise tax would cause the price to rise to 25 cents.
 - A 10 cent sales tax would cause the price to fall to 14 cents, and a 10 cent excise tax would cause the price to rise to 26 cents.
 - A 10 cent sales tax would cause the price to fall to 11 cents and a 10 cent excise tax would cause the price to rise to 21 cents.
 - Neither tax would affect the price.
38. Cars currently sell for \$1500 apiece, plus \$500 sales tax.
- If the sales tax is eliminated, what can you say about the new price of cars?
 - If the sales tax is eliminated and replaced by a \$500 excise tax, what can you say about the new price of cars?
 - If the sales tax is eliminated and replaced by a \$1000 excise tax, what can you say about the new price of cars? co
39. Suppose a new law requires students to give each of their professors a \$100 tip at the end of the semester.
- What happens to the demand for college courses?
 - What happens to the supply of college courses?
 - Are students made better or worse off as a result of this law? What about professors? Justify your answer.
40. Apples currently sell for 50 cents apiece. The government is considering three different plans. Plan A is to subsidize apple purchases; every time you buy an apple, you get a dime back from the government. Plan B is to subsidize apple sales; every time you sell an apple, you get a dime back from the government. Plan C is to tax apple sales: Every time you sell an apple, you pay a dime to the government. When Plan A is instituted, the price of apples rises to 57 cents.
- What would have happened to the price of apples if the government had instituted Plan B instead of Plan A?
 - What would have happened to the price of apples if the government had instituted Plans A and C simultaneously instead of Plan A alone? Justify your answer.
41. Suppose a new law requires every college professor in your city to wear a special uniform while teaching. These uniforms must be rented from the mayor's brother at a cost of \$1 per hour. With the law in effect, universities pay professors \$5.40 per hour.
- If the law were repealed, how much would professors get paid?
 - If the law were replaced by a new law requiring the *universities* to pay for the uniforms (at the same \$1 per hour), how much would professors get paid?
- Each part your answer should be an exact number if possible, or a range of numbers otherwise. (Hint: Remember that the professors are the suppliers of teaching services and universities are the demanders.)
42. The federal government wants to improve the fortunes of domestic car manufacturers and is considering two plans to accomplish this. Under Plan A, every purchaser of a domestic car would receive a \$100 rebate from the government. Under Plan B, car manufacturers would receive a \$100 rebate from the government for every car they sell.

- a) How does Plan A affect the demand for cars?
 - b) How does Plan B affect the supply of cars?
 - c) Compare and contrast the effects of the two plans.
43. Gasoline currently sells for \$3 a gallon. Suppose the government simultaneously institutes a sales tax of 10 cents per gallon and an excise subsidy of 10 cents per gallon. (The “excise subsidy” means that every time you sell a gallon of gasoline, you get a dime from the government.) What is the new price of gasoline? Are demanders helped or hurt by this pair of policies? What about suppliers?
44. The diagram below shows the demand and supply for hamburgers on your college campus.



- a) Suppose your college announces a new plan to improve student life: Any time you buy a hamburger anywhere on campus, you can bring your receipt to the administration building and trade it for a \$5 bill. How much does the price of hamburgers change?
 - b) Suppose instead that the college announces a different plan: It will pay \$5 per hamburger to anyone who sells hamburgers on campus. How much does the price of hamburgers change?
 - c) Which plan is better for the students who like to eat hamburgers? Explain your reasoning.
45. A new law requires each firm to provide its workers with free parking spaces. These spaces are worth \$200 a year to the workers and cost firms \$500 a year to provide. Is this law good for workers? Is it good for firms? Justify your answers.
46. On Monday, the equilibrium quantity of widgets is 200. On Tuesday, the supply curve shifts right by 50 widgets, and the new equilibrium quantity is 230. On Wednesday, the supply curve returns to its Monday position, and the demand curve shifts left by 30 widgets.
- a) Draw separate graphs to illustrate the situations on Tuesday and Wednesday.
 - b) What is the equilibrium quantity on Wednesday?
 - c) Carefully justify your answer to part b) by comparing the locations of specific points on your graphs from part a).

Price Theory and Applications

by

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Solutions to Problem Set for Chapter 1

1. False, in the sense of “not necessarily true.” A fuel-efficient car reduces the price of “miles driven,” so people choose to drive more miles. More driving with greater fuel efficiency could lead to either an increase or a decrease in the amount of gasoline consumed.

If the demand curve for “miles driven” is particularly steep, do Americans increase or decrease their use of gasoline? What if it is particularly shallow?

2. False (in the sense of: not necessarily true). The existence of the new birth control method lowers the “price” of those activities that are capable of producing unwanted babies, and so leads to greater participation in those activities. Since more sexual encounters take place, but each encounter has a lowered probability of leading to an unwanted birth, the number of unwanted births could go either up or down.

To put it another way: after the discovery, there are two sorts of occasions on which people will use the new method of birth control. First there are those occasions when they would have otherwise used a less effective method. Second, there are those occasions on which they would otherwise have refrained from sex altogether. On the first sort of occasion, the new method leads to fewer unwanted pregnancies than previously, but on the second sort of occasion it leads to more.

The example is analogous to the “reckless driving” example in the text. Sometimes students attempt to carry the analogy too far by asserting that the number of unwanted babies must stay about the same (just as, after safety equipment was introduced, the number of driver deaths stayed about the same). But there is no reason why this needs to be true. We have one reason to believe that unwanted pregnancies will decrease (better birth control) and another to believe that they will increase (more people taking chances). Either effect could be bigger than the other, or they might just happen to cancel each other out, as appears to have been the case with auto safety.

Sometimes students attempt to argue that the new method might have no effect since some people will refuse to use it, for reasons of religion or aesthetics. But this is not a good answer, since the fact that *some* people will not use the method doesn’t prove anything. In order to draw any conclusions from this sort of argument, it would be necessary to maintain that *nobody* will use the new method, and this seems implausible.

3. Some other “goods” may be sexual relations, clean air, warm weather or marriage.
4. False. A rise in price leads to a fall in quantity demanded, not a fall in demand. The initial price rise must be caused by either a shift in demand or a shift in supply. The new equilibrium is reached, and no further shifts are needed.
5. a) Supply falls so price rises and quantity falls.
b) Demand rises so price rises and quantity rises.
c) Demand and supply both fall. Quantity falls and price could go either way.
d) As farm workers move to the city to earn the higher wages, the supply of corn falls. Price rises and quantity falls. Sometimes students argue that wealthier industrial workers will demand more corn and therefore the demand curve shifts out as well. This is a commendable insight, but it overlooks the fact that those higher wages

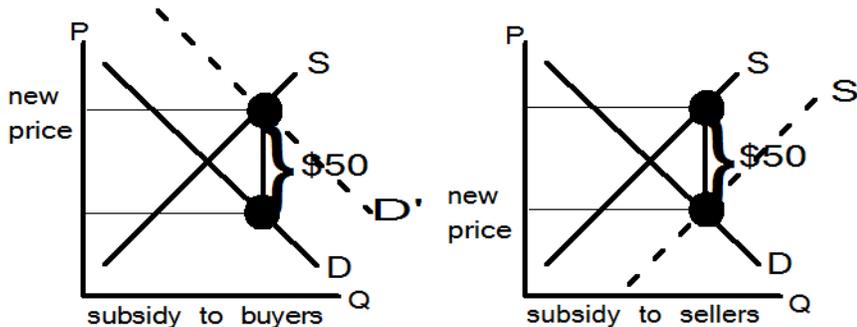
are paid by employers, who might now *reduce* their demand for corn, offsetting the additional demand by the workers. Therefore, unless we know more about why wages went up, we need not expect the market demand curve to shift.

6. a) Demand falls, price falls and quantity falls.
b) Supply increases, price falls and quantity rises.
c) Demand increases, price increases and quantity increases.
d) Demand increases, price increases and quantity increases.
e) Supply increases, price falls and quantity rises.
7. False. The demand curve for apartments shifts downward; therefore the price falls.
8. False. This could be explained, for example, if the supply curves are identical in both places, but the demand curve is higher in New York than in Iowa.
9. False. We are told only that the quantity has fallen. This might equally well be caused by a decrease in demand (in which case price must fall) or by an decrease in supply (in which case the price must rise.)
10. The demand curve for cigarettes shifts rightward by 10 cigarettes per year. The equilibrium quantity of cigarettes increases by less than 10 per year. The number of cigarettes smoked by others is equal to the new equilibrium quantity minus the ten that are thrown away. Thus Nosmo is correct in believing that he reduces the number of cigarettes that other people smoke, but incorrect in believing that he reduces that number by 10 per year.
11. False, the fall in demand would reduce the equilibrium price which would in turn *reduce* the quantity supplied. As a result, there will not be an additional pound of meat for someone else to eat.
12. False. The supply of housing shifts rightward by 1000, so the equilibrium quantity of housing shifts rightward by *less* than 1000.
13. $P = \$ 2.00$ and $Q = 7$ lbs.
14. a) \$.50 \$2.00. 4 pounds.
b) \$2.50, \$.50. 4 pounds.
c) In either case you would not care.
15. a) After the demand curve drops vertically \$5, it crosses the supply curve at a quantity of 3 and price of \$3. Therefore the new price is \$3.
b) After the supply curve rises vertically \$5, it crosses the demand curve at a quantity of 3 and a price of \$8. Therefore the new price is \$8.
c) With a sales tax, consumers pay \$3 plus \$5 tax. With an excise tax, they pay \$8 plus \$0 tax. Either way they pay \$8, so both taxes are equally bad for consumers.
16. False. The Upper Slobbovian demand curve is steeper, so quantity falls by less in Upper Slobbovia.
17. A sales tax has no effect on the price; an excise tax is passed on entirely to the consumer. So, for example, an excise tax of \$1 per head of lettuce causes the price to rise by \$1.

Regarding the excise tax, students commonly reach the correct answer while offering a reason that is quite mistaken. Their (incorrect) argument is this: A vertical demand curve indicates that demanders will pay any price at all for avocados; therefore suppliers are able to pass the tax on completely without losing any sales. The argument is incorrect because it overlooks the fact that suppliers compete with each other. Any given supplier will indeed lose sales if he fails to match the going market price.

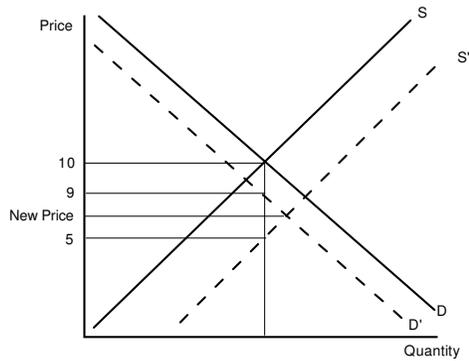
Indeed, to see that the argument cannot possibly be correct, ask yourself why suppliers don't raise their prices *prior* to the tax increase. If suppliers charge \$1 originally and \$1.25 after the imposition of a \$.25 tax, why don't they charge \$1.25 (or more) even *before* the tax is imposed? The reason is that price is determined not by individual suppliers, but by the intersection of supply and demand.

18. a) The demand curve shifts vertically upward a distance \$50. The quick way to see this is to remember that a \$10 sales tax shifts the demand curve down \$10, and a \$20 sales tax shifts the demand curve down \$20, so a sales tax of *minus* \$50 (as in the problem) should shift the demand curve down a distance -\$50, which is to say, up a distance \$50. If that's too glib for you, you should be able to make an argument from first principles, mimicking the argument in Exhibit 1.3.
- b) The new price is higher than the old price, but less than \$50 higher.
19. a) The supply curve shifts downward a vertical distance \$50.
- b) The new price is lower than the old price, but less than \$50 lower.
20. The diagram below shows the effects of the subsidy to buyers from problem 18 and the subsidy to sellers from problem 19. The two darkened points in the left-hand panel are identical to the two darkened points in the right-hand panel, because in each case they are located exactly \$50 apart, with one on the old demand curve and one on the old supply curve. In the left-hand panel, consumers care about the price minus the subsidy, i.e. the price at the lower of the two darkened points. In the right-hand panel, consumers care about the price, i.e. the price at the lower of the two darkened points. Because these two prices are the same, consumers are equally well off under either subsidy.



21. The excise tax shifts the supply curve, which now crosses the demand curve at a lower quantity but still at the original price. So the price does not change and demanders (who care only about the price, not the tax) are unaffected.
22. False. This is true if "high" is replaced with steep and "low" is replaced with flat.
23. The price would fall to 13 cents apiece.
24. a) and e) are possibly true. b) and d) are certainly false because a sales tax cannot cause a price increase. c) is certainly false because an excise tax cannot cause a price decrease.
25. a) The excise tax has caused the price to rise by less than \$15, which means the original price is between \$15 and \$20. When the excise tax is repealed, the price falls back to this original price, i.e. somewhere between \$15 and \$20.
- b) The new price will be \$5 lower than it is under the excise tax, i.e. it will be \$15.
- c) Starting from a graph that shows the \$5 excise tax, the supply curve now shifts upward another \$3, so the price rises, but by less than \$3. The new price is between \$20 and \$23.

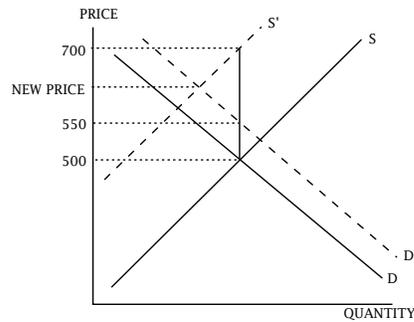
26. The new price will be somewhere between \$5 and \$9. Here is the picture:



27. False. The supply and demand curves both shift downward a distance 50 cents. Therefore the entire picture shifts down 50 cents, so the new equilibrium is 50 cents directly below the old one. In other words, the quantity hasn't changed.
28. False. The excise tax causes the supply curve to shift upward and the sales tax causes the demand curve to shift downward. If you draw some pictures with, for example a very flat demand curve and a very steep supply curve (or vice versa) you'll see that the price can go either up or down.
29. a) The price rises. b) The price rises. c) Both price increases are equal. This is because they both occur at that price where the horizontal distance between the original supply and demand curves is exactly 100.
30. a) It means that everyone will have exactly the same take-home pay regardless of which plan is chosen. Also, employers will have exactly the same labor costs regardless of which plan is chosen. For example, if a tax on workers causes wages to rise to \$6 per hour, then a tax on employers will cause wages to fall to \$5 per hour; either way, workers receive a take-home (after-tax) pay of \$5 per hour and employers spend \$6 per hour to hire labor.
- b) You should draw the demand and supply curves for labor.

A tax on workers causes the supply curve to rise vertically by \$1 and a tax on employers causes the demand curve to fall vertically by \$1. The resulting prices to suppliers and demanders can be shown to be independent of the choice of tax via reasoning as in Exhibit 1-10.

31. a) Demand shifts up by \$50. Supply shifts vertically up by \$200.
 b) The new price of a shower is between \$550 and \$700. (See the picture below.)
 c) It is bad for consumers, who pay more than \$50 for a digital control they value at \$50. It is also bad for suppliers, who enjoy a price increase of less than \$200 though their costs increase by \$200.



Answers to Numerical Exercises

- N1. $P = \$1$, $Q = 800$ oranges/day.
 N2. Supply: $Q = 800 \cdot P - 400$;
 Demand: $Q = -200 \cdot P + 1,000$.
 $P = \$1.40$, $Q = 720$ oranges/day. \$.90.
 N3. Supply: $Q = 800 \cdot P$;
 Demand: $Q = -200 \cdot P + 900$. $P = \$.90$,
 $Q = 720$ oranges/day. \$.90.
 N4. Supply: $Q = 800 \cdot P - 160$;
 Demand: $Q = -200 \cdot P + 940$.
 $P = \$1.10$, $Q = 720$ oranges/day. \$.90.

Chapter Two: Prices, Costs, and the Gains from Trade

General Discussion and Teaching Suggestions

1. The carpenter-electrician example is cooked up to come out neatly, so that there are gains from trade when the two tasks are exchanged at a relative price of one for one. Some ambitious students will try it with other numbers and will be distressed to find that things don't work out so well. Refer them to the numerical exercise at the end of the chapter for a full explanation.

2. A majority of students find the carpenter-electrician example surprising but clear. A few will argue vehemently against the conclusion. Often their arguments will revolve around the possibility of one agent's "paying" the other to perform a task. (For example, the electrician, who has become wealthy through his superior skills, pays the carpenter to do all of the work while he goes to the Riviera; or, the carpenter, who is such a bumbler, pays the electrician to get all of the jobs done right.) The correct response is that "payment" must consist of the delivery of some good. For simplicity, we have assumed that the only two goods in the world are rewiring jobs and paneling jobs. If the student insists on introducing another good to be used as a medium of exchange—say, bananas—then we must add another row to the tables in Exhibit 2-2, for "growing bananas" (in addition to paneling and rewiring). This will complicate the example, but will not change the essential conclusion.

Additional Problems

1. Comment briefly on the merits of the proposal in the following letter to the editor of the *Des Moines Register*:

One of the reasons Iowa farmers are suffering economically is because we are buying too much food which has been processed in other places while we are selling our raw products, i.e., corn, soybeans and livestock, for whatever “the market” dictates.

The solution is for groups of agreeable Iowans, including women and older teenagers, to incorporate and start producing a finished food, i.e., specials breads or pastries, canned or frozen foods or vegetables, corn meal, tofu, etc.

Sell these at farmer’s markets, for school lunches, for food stamps, perhaps the World Trade Center, eventually!

—Mildred Conley

2. *True or False*: A rational society will use its most fertile land for agriculture.
3. Dell computers contain hard drives made by other manufacturers. *True or False*: If Dell made its own hard drives, Dell computers would be cheaper.
4. *True or False*: Consumers pay higher prices in retail markets than they would if they could buy directly from wholesalers, because they have to pay enough to cover two profit margins.
5. Explain exactly where the following argument goes wrong: The Anderson-Little clothing store buys clothes directly from the manufacturers, whereas Brand X clothing stores buy from middlemen. In each case, there are the same costs of producing, shipping, and marketing the clothes, but with Brand X’s system there is also the additional cost of supporting the middlemen. Therefore, clothes will be cheaper at Anderson-Little.

Price Theory and Applications

by

Steven E. Landsburg

Solutions to Problem Set for Chapter 2

1. The relative price of tea decreased. The relative price of Civics increased.
2. You may conclude that he is confused. If the relative price of widgets in terms of gadgets has risen, then the relative price of gadgets in terms of widgets must have fallen.
3. The difference will be smaller.
4. The logic of the “good and bad oranges” example (at the end of Section 2.1) suggests that the average quality of liquor should have risen. But that logic need not apply. It costs about the same to ship a good orange or a bad orange. It does not cost about the same to hide the Jack Daniels distillery and a bathtub full of gin. So: Not necessarily true.
5. There will be a greater percentage of childless couples at the cheap movie. For a childless couple, a show might cost 10 times as much as a movie; add the cost of a babysitter and the show now costs less than ten times as much. So for a childless couple, the show is more expensive relative to the movie (and the movie is cheaper relative to the show) than it is for a couple with children.
6. False. The gains from trade arise from comparative advantages, not absolute advantages.
7. False. If it costs Dryden \$10 an hour to rent time on printing presses, then it costs West \$10 an hour to use its own presses — because the cost of using them is the forgone opportunity to rent them to Dryden.
8. False. Suppose that the going wage for child labor on farms is \$5 per hour. Then the farmer without children must pay \$5 to employ someone else’s children; the farmer *with* children must forgo \$5 per hour (which he could earn by renting his children out to neighboring farmers) to employ his own children. Both face the same cost of \$5 per hour.

Some students argue that the farmer with children incurs the costs of feeding, housing, and education. However, it is *not* correct to count these among the costs of putting the children to work, since they must be paid whether the children work or not.

Other students argue that the farmer with children is wealthier at the end of the year since he makes no cash payments to hire labor. Whether or not this is true, it is irrelevant to the question. The question does not ask which farmer is wealthier; it asks only which farmer has higher costs of harvesting. The answer is that both have the same costs.

9. False, in the sense of “not necessarily true.” The statement of the problem omits the key information that Mary is a highly skilled neurosurgeon, whereas George can do nothing except type. Mary’s greater typing speed does not imply that she has a comparative advantage at typing.

Some students argue that *if* you are an employer who only wants to hire a typist, and *if* George and Mary are available at the same wage rate, then yes, it makes more sense to hire Mary as a typist than to hire George. But even this strained interpretation does not lead to the alleged conclusion. If you can really hire Mary at typist’s wages, then you should set her to performing brain surgery,

collect her fees as revenue to your firm, and use a small part of that revenue to hire George to do the typing.

10. False. The students with the most talent for medicine need not have a comparative advantage in medicine.
11. False, in the sense of not necessarily (or even probably) true. If the people of the country are desperate for food, they ought to engage in that activity which will produce the most food. That activity might be growing food, or it might be producing decorative jewelry and trading it for food.
12. a) 400 bushels of corn. 300 bushels of corn. Oklahoma.
 b) Iowa.
 c) In Iowa 7.6 acres must be used while in Oklahoma 22 acres must be used.
 d) Iowa has .4 extra acres and Oklahoma has 2 extra acres.
13. False. Except in the hairline case in which each country has the same costs for all activities, the country must have a comparative advantage in something (see Exhibit 2.2).
14. False. This puts the Winkies at a comparative disadvantage in producing automobiles but a comparative advantage in producing other goods. Thus, the gains from trade makes *both* the Winkies and the Munchkins better off.
15. False. People trade for two reasons, one of which is different tastes. Some people will choose inferior housing in order to have better cars, or more books, or fancier vacations.

One student answered this question by saying “False, because there are some people who, no matter how high their incomes, would still choose to live in the most disgusting, degrading, infested, and putrid environments imaginable.” An asterisk pointed to a footnote at the bottom of the exam paper which read, “For example, my uncle.”

Answers to Numerical Exercises

N1.a)

	Rewiring	Paneling
<i>Electrician</i>	1/2 Paneling	2 Rewirings
<i>Carpenter</i>	2/3 Panelings	3/2 Rewirings

- b) The electrician. The carpenter.
- c)

	Without Trade	With Trade
<i>Electrician</i>	15 hours	10 hours
<i>Carpenter</i>	25 hours	30 hours

The electrician benefits from this trade, but the carpenter does not.

d)

	Without Trade	With Trade
<i>Electrician</i>	15 hours	12 hours
<i>Carpenter</i>	25 hours	24 hours

Both gain from this trade.

Chapter Three: The Behavior of Consumers

What's New in This Edition

Much of this chapter has been spruced up for this edition. The overall flow of ideas remains unchanged, but I think the presentation is substantially crisper now. Some of the rather difficult material on different tax regimes has been moved from the text to the problem set.

General Discussion and Teaching Suggestions

1) Although the text stresses that opportunities and constraints are determined entirely independently, the point can never be overstressed.

2) My own teaching strategy has been to cover the basics (Sections 3.1 and 3.2) and then to assign some challenging problems that force students to think about the meaning of it all. Since many students have no idea where to begin, I have them work in groups of 4 or 5, with about a week to turn in their solutions. I then go over the solutions in class, and work some additional challenging problems. Students are much better able to follow the additional problems after having worked a few on their own.

Additional Problems

1. Juan buys 10 turnips each year. *True or False:* If the price of turnips rises by 10 cents apiece, and if Juan's tastes and income remain unchanged, then he will have \$1 a year less to spend on other things.
2. It is possible for a community to have too little crime. (Hint: What is the cost of crime prevention?)
3. Writing in the New York Times, radio commentator Ira Eisenberg described the innovative voucher program recently initiated in Berkeley, California:
Instead of shunning street beggars, or grudgingly handing them cash, Berkeley residents can now offer panhandlers vouchers purchased from local merchants. The vouchers are as good as real money for buying food, laundry services, bus fares, even hot showers. They can't be exchanged for alcohol or cigarettes, let alone illegal drugs.
What do you think of Berkeley's voucher plan, and of Mr. Eisenberg's analysis?
4. Assuming that you like to drive, but dislike breathing polluted air, draw your indifference curves between car rides and air pollution. Assuming that you have to breathe one unit of polluted air for each ten miles that you drive, draw the appropriate constraint. What is the optimal amount of pollution for you to breathe? Under what circumstances would it be zero?
5. Draw a typical set of indifference curves between "Smoking" and "Lung Damage" for a person who likes to smoke. Draw the relevant budget constraint. Now suppose that a new cigarette is invented that is identical to currently available cigarettes in every way except that it causes less lung damage per cigarette. Show the new budget line and the new optimum. Could this invention lead to an increase in the number of people who get lung cancer from smoking?
6. Suppose you like driving fast but you hate getting injured.
 - a) Draw a graph with "speed" on the horizontal axis and "probability of injury" on the vertical. Do your indifference curves slope upward or downward? Why?
 - b) Suppose you drive to work every day 40 miles per hour (mph) and have a 5% annual chance of being injured. You are aware that in general your chance of being injured (measured in percent) is always equal to $1/8$ of your driving speed (measured in mph). Draw the relevant budget constraint, and draw a set of indifference curves that could have led to your decision to drive at 40mph.
 - c) In order for your chosen speed to be an optimum, what must be true about the shape of your indifference curves? Must they be concave or convex?
 - d) Suppose that because of a new kind of safety device, the probability of injury falls to $1/10$ of your driving speed. Draw the new budget constraint and the new optimum. Can you determine whether the device causes a fall in your probability of being injured? Can you determine whether the device makes you happier?
7. Suppose you have an income of \$10 and are offered the opportunity to purchase dog collars at \$1 apiece. However, if you buy at least 5 dog collars at that price, then you can buy any number of additional collars at 50 cents a piece. Draw your budget constraint between dog collars and all other goods.

8. Louie consumes only two goods, X and Y . His indifference curves have the usual (convex) shape. He prefers basket $(2, 2)$ to basket $(1, 3)$.
 - a) Is it possible to tell whether Louie prefers $(2, 2)$ to $(3, 1)$?
 - b) Is it possible to tell whether Louie prefers $(1, 3)$ to $(3, 1)$?
9. Daisy consumes only two goods, X and Y . Her indifference curves have the usual (convex) shape. She is exactly indifferent between baskets $(1, 3)$ and $(2, 2)$. Which does she prefer between $(2, 2)$ and $(3, 1)$?
10. Marco has an income of \$12. In Year 1, when buttons and bows each sold for \$1 apiece, he bought 4 buttons and 8 bows. In Year 2, when buttons cost \$.50 apiece and bows cost \$4 apiece, he bought 8 buttons and 2 bows. *True or False:* It is not possible to tell from this information in which year Marco was better off.
11. Akbar and Jeff consume only eggs and wine. With eggs on the horizontal axis and wine on the vertical, Akbar is indifferent between the baskets $(1, 3)$ and $(2, 2)$. Jeff is indifferent between the baskets $(2, 2)$ and $(3, 1)$. They both choose to consume basket $(2, 2)$. They each buy wine for \$1 per bottle. Which one pays the higher price for eggs?
12. Suppose the only goods you buy are bread and circus tickets. When bread sells for \$1 a loaf and circus tickets sell for \$1 apiece, you buy 7 loaves of bread and 3 circus tickets to exhaust your income of \$10. One day the price of bread falls to 50 cents a loaf while the price of circus tickets rises to \$2 apiece and your income remains unchanged. Is it possible to say with certainty whether you are better off? Why or why not?
13. Suppose you divide your income between cheese and other goods. Cheese costs \$4 a pound and you buy 10 pounds a day. One day the price of cheese rises to \$6 a pound and at the same time your income rises by \$20 a day. Do these changes make you better off, worse off, or neither? Illustrate your answer with indifference curves.
14. Dizzyland Amusement Park has begun selling a VIP pass that costs \$20 and entitles the bearer to a discount price on rides. Mickey Duck, as Dizzyland patron, has decided he is definitely happier buying a VIP pass than not buying one.
 - a) In a diagram with “Rides” on the horizontal axis and “All Other Goods” on the vertical axis, illustrate the shift in Mickey’s budget line when he buys the pass.
 - b) *True or False:* Mickey will certainly go on more rides now that he has a VIP pass.
15. Your income is \$100 a week. The grocery store where you shop sells eggs for \$10 apiece and wine for \$20 a bottle. But, starting in June, your Aunt Agnes offers to pay for half your egg purchases, so eggs only cost you \$5 a week. With Aunt Agnes’s offer in place, you buy 12 eggs and 2 bottles of wine each week.
 - a) Draw a diagram that illustrates your budget lines in May and June.
 - b) In June, how much is Aunt Agnes spending on you per week? (Your answer should be a number of dollars.)
 - c) In July, Aunt Agnes stops subsidizing your egg purchases and instead gives you a weekly cash gift equal to the amount you calculated in part b). Add your July budget line to the picture.

- d) *True or False:* You are exactly as happy in July as in June. Use your diagram to justify your answer.
16. Herman has an income of \$10, which he spends on fishheads and all other goods. Fishheads cost \$1 apiece.
- Suppose the government agrees to pay half of Herman's fishhead bill, so that fishheads now cost him only 50 cents apiece. He now chooses to buy 8 fishheads. Show how the government program affects Herman's budget line, and show his new optimum point. Call it P . What are the coordinates of the point P ?
 - Now suppose the government ends the program in part a) and replaces it with a new and simpler program: Herman just gets a cash gift of \$4. Show his new budget line. Does it go above, below or through point P ? How do you know?
 - Of the two programs in parts a) and b), which is more expensive for the government? Which does Herman prefer? Justify your answers.
17. On Monday, eggs sell for \$2 each and wine sells for \$4 a bottle. On Tuesday, the price of eggs rises to \$3 each and the price of wine falls to \$3 a bottle. Amanda and Jeter both have incomes of \$24 on Monday and on Tuesday. On Monday, Amanda buys 4 eggs and 4 bottles of wine. On Tuesday, Jeter buys 2 eggs and 6 bottles of wine.
- On which day is Amanda happier? Use a graph to justify your answer.
 - Can you determine whether Amanda and Jeter have identical tastes?
18. Kramden's Grocery advertises "We randomly chose 10 of our customers and calculated how much they'd have paid for their market baskets at Norton's Supermarket. At Norton's they were an average of 6% higher." Does this convince you that wise shoppers will shop at Kramden's? Why or why not?
19. Suppose that the only items you consume are bread and wine. One day the price of wine increases, and simultaneously your income increases. You notice that you are exactly as happy as you were before either change took place.
- What happens to the quantity of wine that you consume? To the quantity of bread?
 - Can you still afford your original market basket if you want it? Illustrate your answer with indifference curves.
(Note: After Chapter Four has been covered, this problem is much easier. Assigning it now forces the students to develop for themselves some skills that will be useful in Chapter Four. It does appear in the textbook at the end of Chapter Four.)
20. Suppose that the only goods you consume are apples and peaches. One day the price of apples goes up, and the price of peaches goes down, and you find that you can still just afford to buy the same combination of apples and peaches that you were buying all along. *True or False:* The price changes leave you neither better nor worse off.
21. *True or False:* It makes no sense to say that an hour of your time is worth exactly \$10, since you engage in many different activities, and the value of an hour devoted to one of them might be quite different than the value of an hour devoted to another.
22. Consider the baskets $A = (1, 3)$, $B = (2, 2)$ and $C = (3, 1)$. Notice that these baskets lie along a straight line. Jack is indifferent between baskets A and B . Jill is indifferent between baskets B and C . Is it possible that Jack and Jill

could have identical tastes? Justify your answer. (You should assume that indifference curves have the usual shape.)

23. Basket A contains 1 X and 5 Y's. Basket B contains 5 X's and 1 Y. Basket C contains 3 X's and 3 Y's. On Monday you are offered a choice between Basket A and Basket C, and you choose A. On Tuesday, you are offered a choice between Basket B and Basket C, and you choose B. *True or False:* We may infer that your tastes changed overnight.
24. Suppose the basket of goods you buy in 2014 costs more, at 2013 prices, than the basket you bought in 2013 would cost at those prices. Can you say for certain in which year you are better off?
25. Cassie shops at Wegmans supermarket, where she spends \$20 per week to buy 10 apples and 5 bananas. If she bought the same 10 apples and 5 bananas at Tops supermarket, she'd pay \$30. *True or False:* Cassie is wise to continue shopping at Wegmans.
26. John buys eggs for \$2 a dozen and bacon for \$5 a pound. Sarah buys eggs for \$5 a dozen and bacon for \$2 a pound. Can you determine whether John and Sarah have identical tastes?
27. John buys shoes for \$1 a pair and socks for \$1 a pair. His annual income is \$20.
 - a) Draw John's budget line.
 - b) Now suppose the government institutes two new programs. First, it taxes shoes, so that shoes now cost John \$2 a pair. Second, it gives John an annual cash gift of \$10. Draw his new budget line.
 - c) Suppose that with the new programs in place, John chooses to buy 10 pairs of socks and 10 pairs of shoes. Has the pair of government programs made him better off, worse off, or neither?
28. The Pullman Company has a lot of pull in the town of Pullman, Illinois. Everybody in town is identical, and they all work for the company, which pays them each \$10 a day. Their favorite food is apples, which they get from a mail order catalogue for \$1 apiece.
 - a) Draw the typical resident's budget line between "apples" and "all other goods" (measured in dollars). Draw in the optimum point.
 - b) Pullman plans to lower the wage rate to \$8 a day. Draw the new budget line.
 - c) Pullman has discovered that if residents are less happy than they were at \$10 a day, they will all leave town. To prevent this, Pullman has offered to subsidize everyone's apple purchases: From now on, if you are a Pullmanite who buys an apple, you will pay only a fraction of the cost and the company will pay the rest. Pullman plans to choose a fraction which is just large enough to keep people from leaving town. Draw the new budget line. Indicate the new budget point. Label the corresponding quantity of apples A .
 - d) Use your graph to illustrate the amount that Pullman spends on the apple subsidy. (Hint: How much of your \$8 income do you have left over after buying A apples? How much of your \$8 income *would* you have left over if you bought A apples at the unsubsidized price of \$1 apiece? Where is the difference coming from?)
 - e) *True or False:* Pullman could end up spending just as much on the apple subsidy as it saves by lowering wages.

29. The Pullman Company has a lot of pull in the town of Pullman, Illinois. Everybody in town is identical, and they all work for the company, which pays them each \$10 a day. The company runs the government, pocketing all tax revenue for itself. Residents eat apples, which they purchase from a mail order company for \$1 apiece. But the company imposes a 100% sales tax, so residents actually pay \$2 apiece for apples.
- Draw the typical resident's budget line between "apples" and "all other goods" (measured in dollars). Draw in the optimum point. Label the corresponding quantity of apples A .
 - Use your graph to illustrate the amount of revenue that Pullman derives from the apple tax. (Hint: How much income do you have left after buying A apples? How much income *would* you have left if you had bought the same number of apples at the untaxed price of \$1 apiece? Where is the difference going?)
 - Pullman wants to lower the wage rate to \$8 a day. Unfortunately, if residents become any less happy, they will all leave town. However, Pullman has calculated that eliminating the apple tax would be just enough to convince people to stay in town at a wage of \$8 a day. Assuming that Pullman lowers the wage and eliminates the tax, draw the new budget line.
 - True or False:* The combined changes described in part (c) leave Pullman neither better nor worse off than before.

Warning to instructors: The following three problems are considerably more difficult than the preceding two, although all have more or less the same flavor.

30. The Pullman Company has a lot of pull in the town of Pullman, Illinois. Everybody in town is identical, and they all work for the company, which pays them each \$10 a day. Their favorite food is apples, which they get from a mail order catalogue for \$1 apiece. However, the company subsidizes apple purchases, so that every time you pay \$1 for an apple, you get back 50 cents from the company.
- Draw the typical resident's budget line between apples and dollars.
 - Pullman has decided to eliminate the apple subsidy. But to avoid discontent among the workers, it plans to simultaneously raise the wage rate by just enough to keep workers exactly as happy as they have always been. Draw the typical worker's new budget line.
 - On your graph, illustrate the amount that Pullman spends per worker in the original situation (be sure to count the wage *plus* the amount spent on the subsidy!). Illustrate the amount Pullman spends per worker after the subsidy is cut and the wage is raised. Was Pullman wise to institute these changes?
31. The Pullman Company has a lot of pull in the town of Pullman, Illinois. Everybody in town is identical, and they all work for the company, which pays them each \$10 a day. Their favorite food is apples, which they buy at the company-owned grocery store for \$1 apiece. The company buys its apples for \$1 apiece and therefore earns no profit at the grocery store.
- Draw the typical resident's budget line between apples and dollars.
 - Pullman has decided to raise the price of apples to \$2 apiece. But to prevent dissatisfied workers from leaving town, Pullman must simultaneously

- raise wages so that workers are just as happy as before. Draw the new budget line.
- c) *True or False:* Although Pullman is now paying higher wages, it is also earning profits at the grocery store. Thus increasing the price of apples might or might not have been a wise move.
32. Suppose you have 24 hours per day to allocate between leisure and working at a wage of \$1 per hour. Draw your budget line between leisure and dollars. One day the government simultaneously institutes two new programs: a 50% income tax and a plan whereby everybody in the country receives a gift from the government of \$6 per year.
- Draw your new budget line.
 - Suppose the government chose the level of \$6 for the gift because it precisely exhausts the income from the tax. Explain why this means that the average taxpayer must be paying exactly \$6 in tax.
 - Assume that you are the average taxpayer, and draw your new optimum. Is it on, above, or below your original budget line?
 - As the average taxpayer, are you working harder or less hard than before the programs went into effect? Are you happier or less happy? How do you know?
33. Suppose you have 30 years of life which can be allocated between leisure and working at a wage of \$10,000 per year.
- Draw your budget constraint between “leisure” and “lifetime income”.
 - Suppose now that you are given the option to attend college, in which case you will have only 26 years available for leisure and working, but your wage will be higher than \$10,000 a year. Suppose also that you are exactly indifferent between attending college and not attending college. Illustrate this situation with budget lines and indifference curves.
 - True or False:* If you attend college, you will definitely spend more time working than if you do not attend college. Justify your answer.
34. Suppose you have an income of \$15 per month and can buy meat for \$1 per pound.
- Draw your budget constraint between meat and dollars.
 - Now suppose the government imposes a sales tax that raises the (after-tax) price of meat to \$1.50 per pound. After the tax is imposed, you buy 4 pounds of meat per month. Draw your new budget line and your new optimum point.
 - Now suppose that, while continuing to collect the sales tax, the government gives you a cash gift of \$2 per month. Draw your new budget line and the new optimum.
 - In part c), the combination of the sales tax and the cash gift leaves you just as happy as you were to begin with.
35. Your income is \$50 a week and you can buy meat at \$10 a pound.
- Draw your budget line between “meat” on the horizontal axis and “dollars” on the vertical.
 - Suppose that the government starts a new program that will allow you to buy as much meat as you want to, with the government paying half of the cost. Draw your new budget line and your new optimum point. Call it A.
 - Now suppose that the government cancels the program but replaces it by a new program, under which you are given just enough cash each week so

- that you can just afford to buy basket A. Draw your new budget line.
- d) Which government program do you like better, the one where they pay for half your meat or the one where they give you the cash? Use your graph to justify your answer.

The next two problems are somewhat more difficult. They can be made easier by replacing the phrase “Show the location of your new optimum point” with “Explain why your new optimum point must occur at the intersection between your old and new budget lines.”

36. Suppose the government imposes a sales tax on food and simultaneously gives you a cash gift every year. Suppose the amount collected in tax is exactly equal to the size of the gift.
- Use a graph showing how this combined program affects your budget line between “food” and “all other goods” (measured in dollars). Show the location of your new optimum point.
 - True or False:* The combined program leaves you neither better nor worse off than before it was instituted.
37. Suppose the government imposes an annual head tax and simultaneously begins subsidizing food purchases. Suppose the amount collected in tax is exactly equal to the size of the subsidy.
- Use a graph showing how this combined program affects your budget line between “food” and “all other goods” (measured in dollars). Show the location of your new optimum point.
 - True or False:* The combined program leaves you neither better nor worse off than before it was instituted.
38. Suppose you have a choice between attending two colleges. At Eli College, you pay \$100 per credit hour, and can take as many or as few credit hours as you like. At Leland College, you pay \$500 per year and are required to take exactly 10 credit hours.
- Assuming you have \$2,000 to spend, draw your budget constraint between credit hours and dollars. (Hint: The constraint includes all those points you can reach by attending Eli *and* all those points you can reach by attending Leland.)
 - Suppose you choose to attend Leland College. *True or False:* If Eli lowers its price to \$50 per credit hour, you will surely transfer to Eli. (Assume that both colleges are identical except for the price, and that it costs you nothing to transfer.)
39. You have an income of \$120 per week and own a car that costs \$2 per mile to drive. You choose to drive 50 miles per week.
- Draw your budget constraint between “miles driven” and “all other goods”, with “all other goods” measured in dollars. Show your optimum point.
 - Suppose you are offered the opportunity to purchase for \$60 a car that costs 50 cents a mile to drive. If you do this, you’ll throw your old car away. Draw the budget constraint that results if you buy the new car. Note that the two budget constraints cross at (40, 40).
 - Would you buy the new car? Defend your answer using indifference curves.
40. Suppose you get rid of your old gas-guzzler and buy a new, fuel efficient car. Driving is now cheaper, but on the other hand, you have to make monthly car payments. You find that on balance, you are exactly as happy as you were

before. Illustrate this situation using indifference curves between “car rides” and “all other goods”. Are you driving more or less than you did before?

41. Suppose that eggs sell for \$1 a dozen, wine sells for \$1 a bottle, and your income is \$12.
- a Draw your budget line.
 - b Suppose that the government imposes a sales tax on eggs, causing the price (to demanders) to rise to \$2 a dozen. At the same time, the government sends everybody in America a check for \$4. You now choose to buy 4 dozen eggs and 8 bottles of wine. Draw your new budget line and your new optimum point.
 - c How much does the sales tax add to the cost of the basket (4, 8)?
 - d *True or False:* Because you get \$4 back from the government, you end up just as happy as you were to begin with. Use your diagram to justify your answer.
42. Suppose that the government issues \$100 worth of food stamps to everybody in your city. These food stamps are coupons that can be exchanged for \$100 worth of food at the grocery store, but they can be used only by the person to whom they are issued.
- a) Draw your budget constraint between food and all other goods both before and after the food stamps are issued. In doing so, measure food in units such that 1 unit of food sells for \$1, and assume that your income before the food stamps were issued was \$500.
 - b) Suppose that you find that you would prefer to sell some of your food stamps for their dollar value, if only you were allowed to. What can we conclude about the marginal value of food?
43. Suppose that you have 16 waking hours per day, which you can allocate between working for a wage of \$1 per hour and relaxing. Draw your budget constraint between “dollars” and “hours of relaxation.” Now suppose that you invent a pill that enables you to get by on 4 hours sleep per night, and therefore have 20 waking hours per day. Draw your new constraint. Is it possible that you will now choose to work fewer hours than you did before?

Now suppose that at the same time, the pill stops working (so that you’re back to 16 waking hours a day) and your wage goes up to \$1.50 per hour. Draw your new budget constraint. Suppose you find that the wage increase makes it possible for you to attain the same combination of dollars and relaxation that you chose when you had the pill. How much will you work after the wage increase, compared with how much you worked when you had the pill?

44. (*Warning: This is a hard problem.*) Suppose that you have available 16 working hours per day, which you can allocate between growing apples and relaxing. Show how you decide on your allocation. Now the government decides to institute a tax whereby $x\%$ of your apples are taken away and discarded. Show your new allocation of time. Suppose that the government wants to acquire exactly A apples through this tax. How will they choose x ? Now suppose that a change in your metabolism causes you to have 20 waking hours per day instead of 16. The government wishes to change the tax rate x so as to still collect A apples from you. How do they choose the new x , and where is your new optimum?
- Could you be worse off at your new 20 hour a day optimum than at your old 16 hour a day optimum?

45. Suppose you expect to earn \$10 this year and \$10 next year. Each dollar you earn this year can be either spent, or saved at an interest rate of 10%. If you want to spend more than \$10 this year, you can borrow money at 10% interest and repay it next year. Next year, you plan to pay off your debts (if any), then spend all your earnings and all your savings (if any).
- Draw your budget line between “dollars spent this year” and “dollars spent next year”.
 - Suppose the government imposes a 50% income tax on all your earnings this year and next year (not including your interest earnings). Draw your new budget line.
 - Suppose the government imposes a 50% sales tax on everything you buy this year and next year. Draw your new budget line.
 - Suppose the government imposes a 50% income tax on all your earnings this year and next year, including your interest earnings. Draw your new budget line.
 - True or False:* If interest earnings are *not* subject to income tax, then an income tax and a sales tax will lead you to spend exactly the same amount both this year and next year.
46. Suppose the government imposes a *temporary* sales tax—one that is in effect for a short time, but will disappear in the future. The government is considering two different tax policies:
- A big excise tax on eggs. This would cause the price of eggs to triple.
 - A smaller excise tax on both eggs and wine. This would cause the price of both eggs and wine to double.
- Illustrate your original (no-tax) budget line and your budget line under Policy *A*. Mark your optimum point.
 - Suppose that, coincidentally, the government would collect exactly as much money from you under Policy *B* as under Policy *A*. Illustrate your budget line under Policy *B*. How does your graph illustrate the fact that the two policies cost you equal amounts of money?
 - Which policy do you prefer? Why?
47. Suppose the government imposes a *temporary* sales tax—one that is in effect for a short time, but will disappear in the future. In a diagram relating current consumption to future consumption, how does your budget line shift? Which is preferable: a permanent sales tax or a temporary sales tax (assuming the rates are adjusted so they collect equivalent revenues)?
48. Mr. Smith has a very low income and Mr. Jones has a very high income. They both purchase education from the same private school.
- In a single diagram, draw budget lines between “education” and “all other goods” for both Mr. Smith and Mr. Jones. Now suppose the government offers a certain quantity of free education with the proviso that if you accept the offer, you must consume exactly that quantity, no more and no less. Draw Mr. Smith’s new budget constraint and Mr. Jones’s new budget constraint. (*Hint:* Mr. Smith’s new budget constraint is no longer a line, but a line and a point; likewise for Mr. Jones.)
 - Suppose Mr. Smith accepts the government’s offer and Mr. Jones rejects it. Is it possible that Mr. Smith and Mr. Jones have identical tastes?
49. Suppose you are a government policymaker and your goal is to make poor people happier. You can do so by subsidizing their food, education and medical care, or you can do so by giving them cash.

- a) On the basis of your answer to Problem 22 in the textbook, make an argument in favor of giving cash.
 - b) On the basis of your answer to the preceding problem in this manual, make an argument for subsidizing education instead of giving cash. (Hint: Suppose you want to help only the poor, but it's difficult for you to tell who's poor and who's rich, and you are worried that rich people will try to claim a share of the cash giveaways.)
 - c) Can you think of a reason why governments would want deliberately to limit the quantity or quality of education available at public schools?
50. Mr. Jones can purchase varying quantities of education from private schools at a going price. One day there opens in Mr. Jones's neighborhood a public school that he may attend for free if he wants to. However, if he attends the public school, he must accept the amount of education that it offers. He can no longer take any private school classes because the public and private schools are in session at the same time.
- a) Draw Mr. Jones's old and new budget constraints.
 - b) Draw a set of indifference curves that implies Mr. Jones will increase his consumption of education when the public school opens. Draw a set that implies his consumption of education will not change. Draw a set that implies he will decrease his consumption of education. Call these the indifference curves of Mr. A. Jones, Mr. B. Jones and Mr. C. Jones. Can you rank Mr. A., Mr. B., and Mr. C. in terms of how much they seem to like education?
 - c) *True or False:* If most people are reasonably but not fanatically fond of education, then an offer of free public education could reduce the quantity of education consumed.

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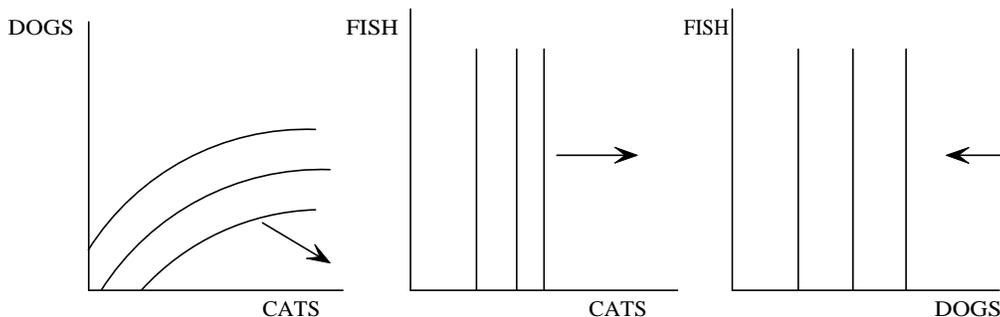
Price Theory and Applications

by

Steven E. Landsburg

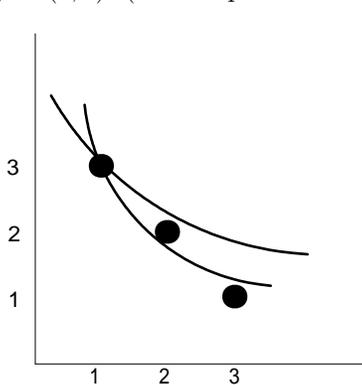
Solutions to Problem Set for Chapter 3

1. False. This statement confuses a change in opportunities with a change in tastes.
2. The indifference curves are parallel lines with slope $-1/2$ (assuming you've put nickels on the horizontal axis). The marginal value of a nickel is $1/2$ dime.
3. The indifference curves are *L*-shaped, with corners at $(1, 1)$, $(2, 2)$, etc.
- 4.

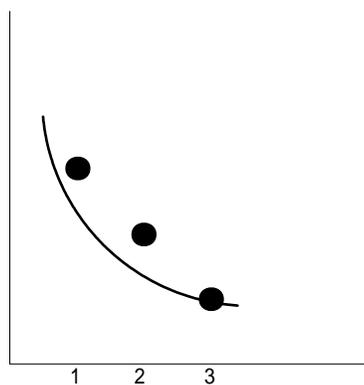


In each case, the arrows point in the "upward" direction.

5. Drawing an indifference curve through both $(1,3)$ and $(2,2)$, you will find that it must pass above $(3,1)$. Therefore Huey prefers both $(1,3)$ and $(2,2)$ to $(3,1)$.
6. a) You should be able to draw an indifference curve through $(1,3)$, passing above $(3,1)$ and also above $(2,2)$, and a different indifference curve through $(1,3)$ passing above $(3,1)$ but passing below $(2,2)$. Since either of these indifference curves might belong to Dewey, it is impossible to tell whether he prefers $(1,3)$ to $(2,2)$. (See the picture below.)
- b) If Dewey's indifference curve through $(3,1)$ passes above $(2,2)$, it must also pass above $(1,3)$, contrary to the assumption in the problem. Thus Dewey can't prefer $(3,1)$ to $(2,2)$. (See the picture below.)

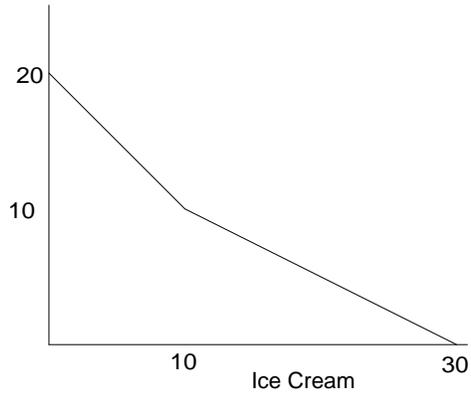


a) Either curve is possible.

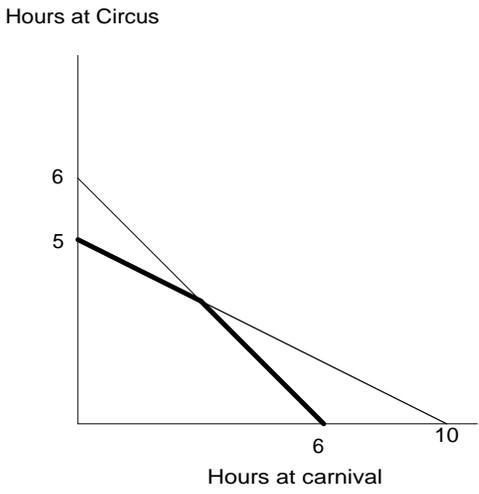


b) In order for the curve to pass below $(1,3)$, it must also pass below $(2,2)$

7. The picture looks like this:
All Other Goods



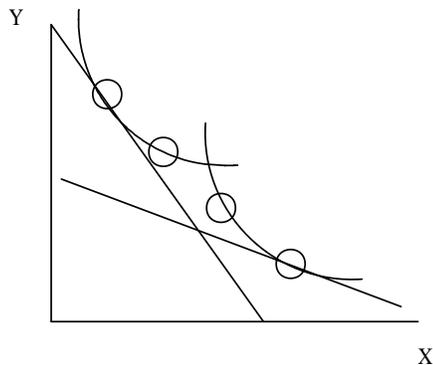
8. a) You can have up to 6 hours at the carnival or up to 6 hours at the circus, so your budget constraint is the line through (6, 0) and (0, 6) in the picture below.
b) If you had unlimited time, you could afford up to 10 hours at the carnival or up to 5 at the circus, giving you the budget line that stretches from (0, 10) to (5, 0). But because you must be either on or inside *both* your “time” budget line and your “money” budget line, you are constrained to the bold-faced segments in the picture below; those segments constitute your overall budget line.



9. True: With nonconvex indifference curves you always specialize in the consumption of either X or Y. A small price change might or might not induce you to switch specializations. If you are specialized in Y and remain specialized in Y, then your consumption of X is left unchanged. If you are specialized in Y and switch to being specialized in X, then your consumption of X changes dramatically. A third possibility is that you are specialized in X and remain specialized in X, in which case your consumption of X will change by a small amount.

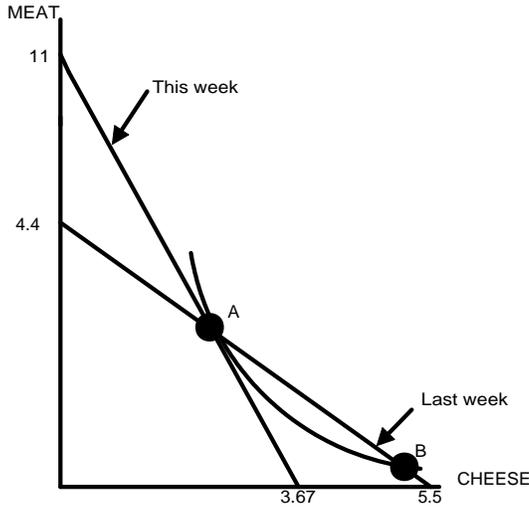
10. a) Because typing and filing are not “goods,” we need to rethink the shape of the indifference curves. First, notice that for a given basket A, baskets to the southwest of A are preferred to A and baskets to the northeast of A are inferior to A. Thus no such baskets can be on the same indifference curve as A. The only baskets that *can* be on the same indifference curve as A are to the northwest and southeast of A; it follows that the indifference curves slope downward.
- b) The slope of the indifference curve is -2 , indicating that you’d be willing to trade 1 hour of typing for 2 hours of filing. If you hated typing even more, you’d be willing to trade 1 hour of typing for even more hours of filing; thus the indifference curve would be steeper (with a slope, for example, of -3 or -4).
- c) When you’re doing a lot of typing, you’re likely to be willing to make bigger sacrifices to avoid yet another hour of it. Thus the indifference curve is steeper near baskets with a lot of typing and little filing, and shallower near baskets with less typing and much filing. In other words, they bow outward from the origin.
- d) The line has slope -1 and intersects both axes at 8 hours.
- e) At $(3, 5)$, the indifference curve is steeper than the budget line. Thus your optimum point—the tangency of an indifference curve with the budget line—must occur below and to the right of $(3, 5)$. In other words, you will now type more than 3 hours per day.

11.

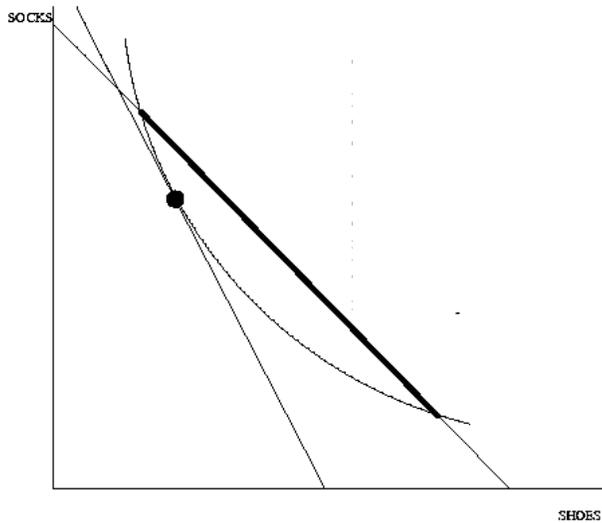


- a) Filbert’s and Lychee’s indifference curves cross; therefore they have different tastes.
- b) Filbert and Lychee’s budget lines have different slopes; therefore they pay different prices.
12. Both budget lines pass through the point $(6,4)$, and there is an indifference curve through the 2013 budget line at that point. The 2014 budget line is steeper, which requires its tangency with an indifference curve to lie above and to the left of $(6,4)$; moreover this indifference curve must lie above the curve through $(6,4)$. Therefore 2014 is the year in which you eat more pizza and the year in which you are happier.
13. The picture below shows last week’s budget line and this week’s budget line. This week Susan chooses point $A = (3, 2)$. We can check that this basket is on this year’s budget line: $3 \times \$6 + 2 \times \$2 = \$22$. (If this equation weren’t true, we could conclude that there was a mistake in the problem.) We can also verify that this basket is on *last* week’s budget line: $3 \times \$4 + 2 \times \$5 = \$22$. Therefore the point A is on both budget lines, which means it must be at the intersection of the budget lines. We know that Susan chooses point A this week, so her indifference curve through A must be tangent to this week’s budget line, as shown. To avoid crossings, the tangent to last week’s budget line must be somewhere between points A and B ,

necessarily on a higher indifference curve than the one pictured. Therefore Susan was happier last week than this week.

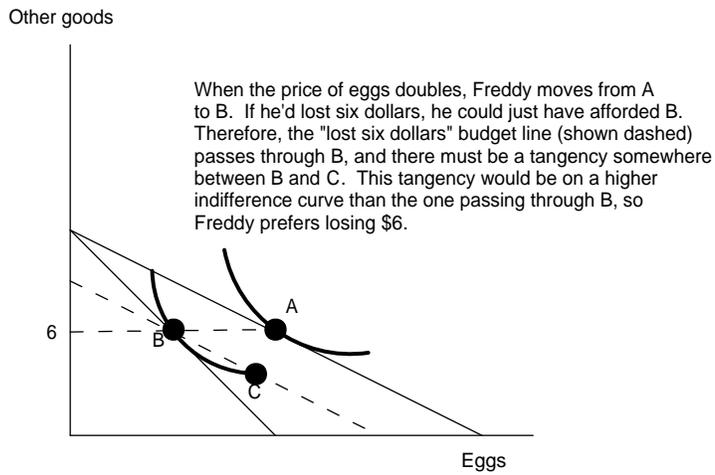


14. Note: the diagram below is not to scale. In 2013 you choose the marked tangency at (12,6). In 2014 you choose a point on the darkened part of the flatter budget line. The entire darkened portion lies to the right of the crossing at (10,10). Therefore you definitely buy more than 10 pairs of shoes in 2014. But the darkened portion lies partly to the left of the tangency at (12,6). Therefore you might buy either more or fewer than 12 pairs of shoes in 2014.



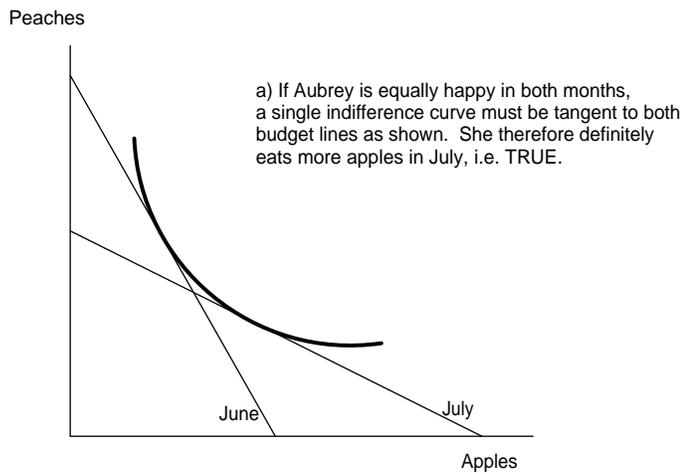
15. With eggs on the horizontal axis and other goods (measured in dollars' worth) on the vertical, your original budget line passes through (12,0) and (0,48), with your optimum at (5,28). If you join the egg club, your new budget line passes through (19,0) and (0,38) (thus it is flatter than the original) and it passes through your original optimum at (5,28). Therefore it is tangent to a higher indifference curve (somewhere below and to the right of (5,28)), which means you should join the egg club.

16.

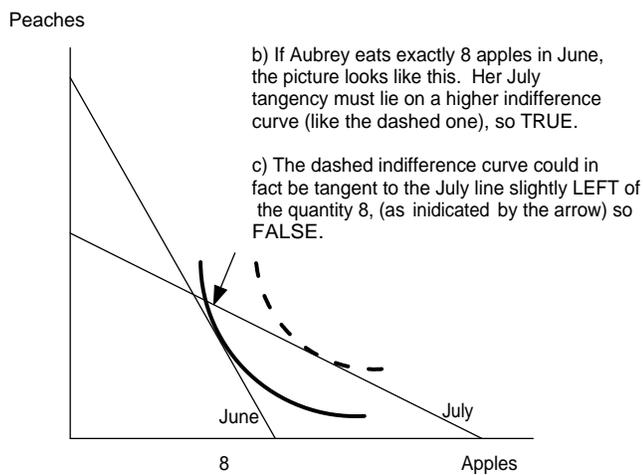


17.

a)

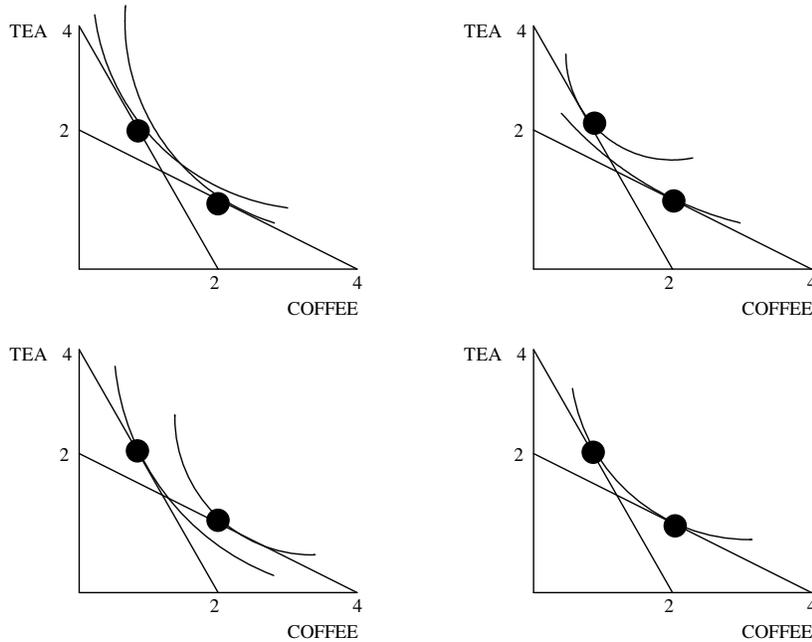


b,c)



18. a) 1. b) 3. c) 2.

19.

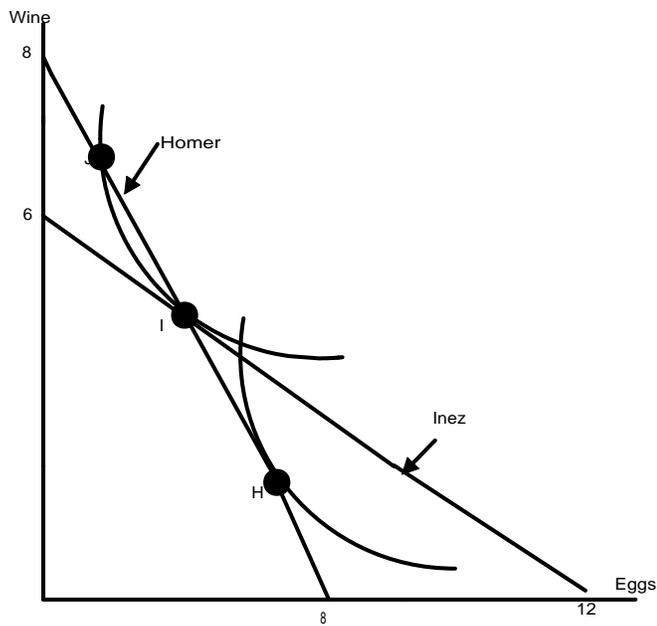


The pictures show four possible configurations. In the first of the four, Amelia and Bernard have crossing indifference curves, and hence different tastes. In the last of the four, Amelia and Bernard share an indifference curve, but this doesn't prove they share *all* their indifference curves; hence they might or might not have different tastes. In the other two pictures, Amelia and Bernard might or might not have different tastes for multiple reasons: first, we can't tell whether the pictured indifference curves cross after they are extended further, and second, even if the pictured curves don't cross, we can't infer anything about all the unpictured curves. So reviewing the four pictures, we see that the answer to the "same tastes" question is: Maybe no, or maybe maybe, or maybe maybe, or maybe maybe. Which adds up to maybe.

20. Drawing the picture, you should see that Chris's indifference curve through (2, 1) crosses David's indifference curve through (1, 2). Therefore their tastes must differ.

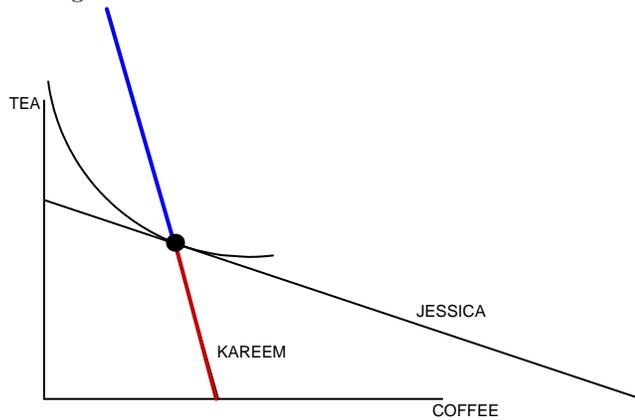
21. Evelyn and Frederick could have identical preferences.

22. Inez's consumption point is on Homer's budget line and Homer's is below Inez's budget line, so the picture looks like this (with Inez consuming at point *I* and Homer at point *H*):

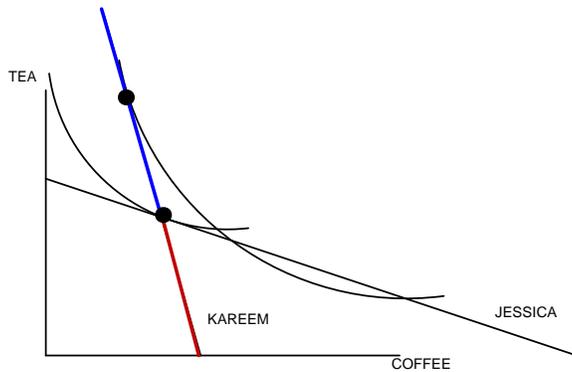
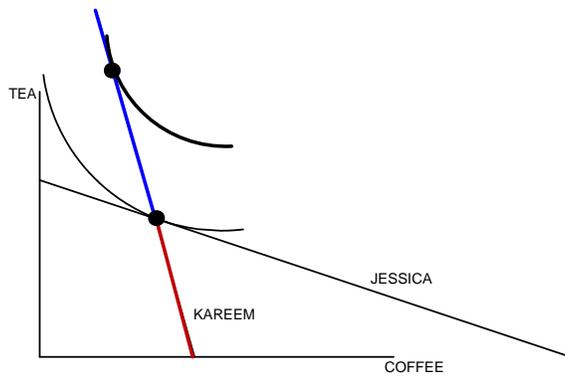


- a) The pictured indifference curves cross, so Homer and Inez do not have the same tastes.
- b) If Inez could pay the same prices as Homer, she'd have Homer's budget line and would choose a point between *I* and *J*, which would make her happier.

23. Kareem can just afford Jessica's basket, so her basket must be at the intersection of the budget lines as shown:

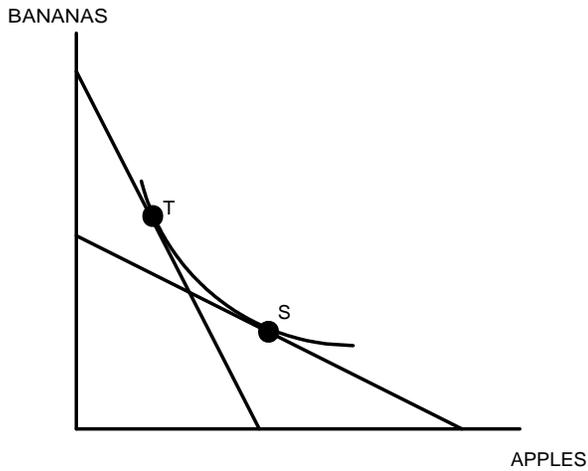


We are not told where Kareem's basket is, so we have to consider various possibilities. If his basket is on the red part of his budget line, then certainly his indifference curve and Jessica's must cross, so their tastes are different. If his basket is on the blue part of his budget line, there are the following two illustrated possibilities:



In the bottom panel, Kareem is happier with his own budget line than he would be with Jessica's, which is contrary to what's given in the problem, so we can rule this case out. In the bottom panel, which is consistent with what's given in the problem, the indifference curves cross. Therefore in all cases consistent with the problem specification, Kareem and Jessica must have different tastes.

24. The picture looks like this:

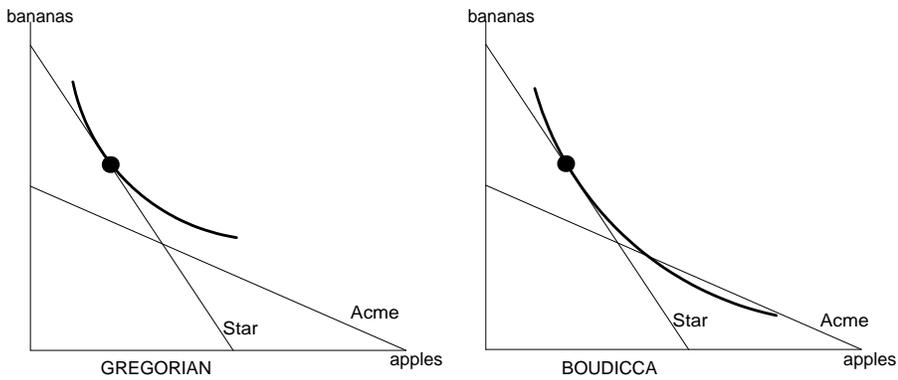


It's true, as Tops advertises, that the Tops basket would be more expensive at Star (that is, it's outside the Star budget line). But it's equally true that the Star basket would be more expensive at Tops.

The insight is that when Cassia goes to Tops, she buys more bananas, because Tops is where bananas are relatively cheap. She can't afford this basket at Star, where bananas are relatively expensive. But when she goes to Star, she buys more of what's relatively cheap at Star, and ends up with a basket she can't afford at Tops.

25.

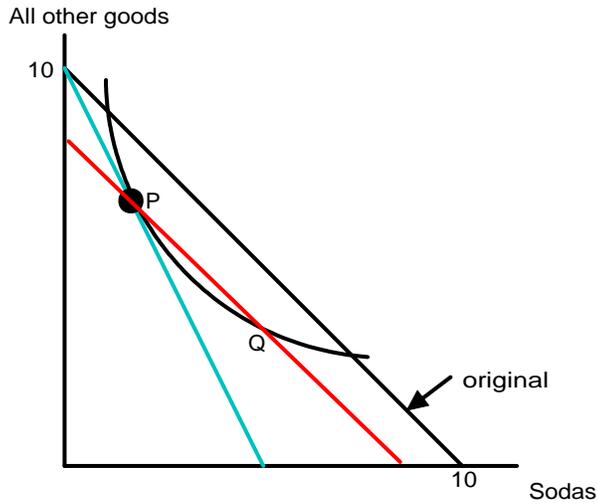
a) Here is the graph:



b) The key difference is that Gregorian's indifference curve through (6,18) passes *above* the Acme budget line, while Boudicca's passes *below* the Acme budget line.

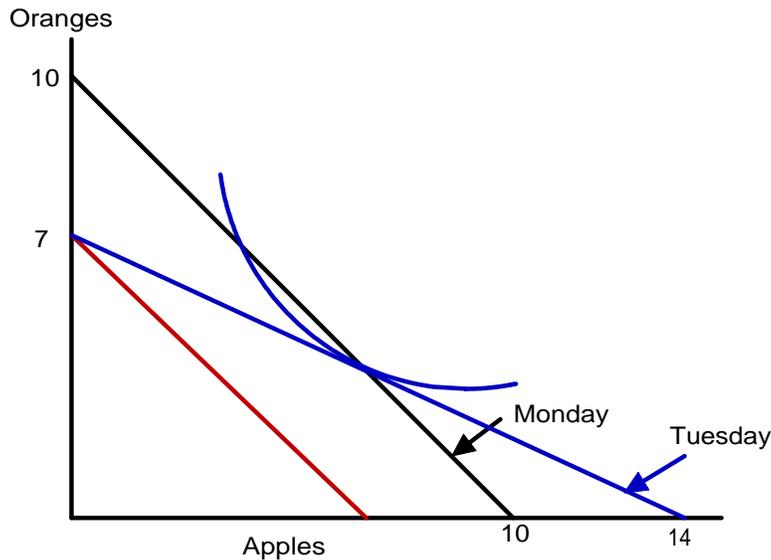
c) True; you can see in the picture that her new tangency must lie to the right of the point (10,10) where the budget lines cross.

26. a) In the diagram below, your new budget line is shown in blue.

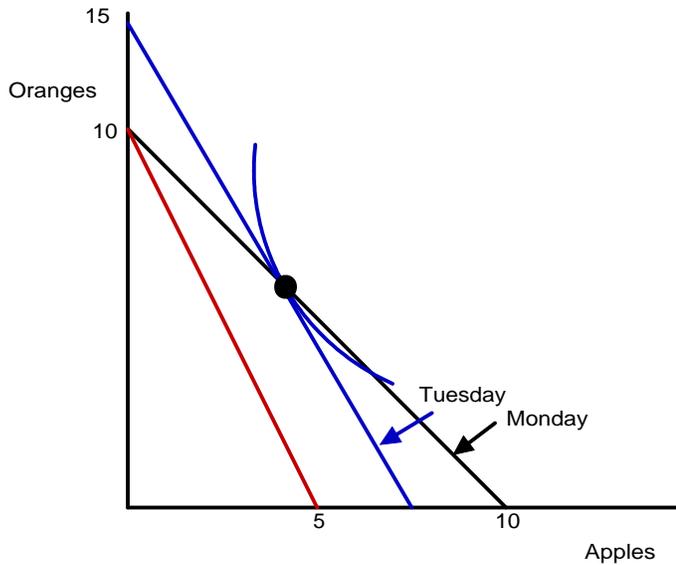


b) Your new budget line is the red line above, passing through P . You can now achieve a point between P and Q and are therefore better off.

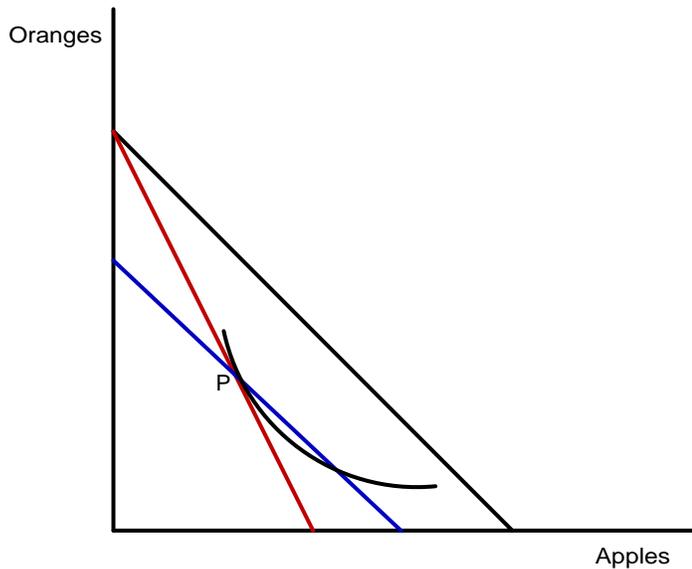
27. In the diagram below, the head tax shifts your budget line to the red line; then the subsidy pivots it out to the blue line. If you buy 6 apples, you pay \$3 and have \$4 left over for other goods, so you're at the point (6, 4), which is also on your original budget line. Therefore the tangency is as shown. Your Monday budget line must therefore be on a higher indifference curve, i.e. you are worse off on Tuesday.



28. In the diagram below, the sales tax pivots your budget line in to the red line; then the cash gift shifts it out to the blue line. When you purchase 5 apples, you have \$5 left over, so your new tangency is at (5, 5), which is also on the original line. Therefore the tangency is as shown, and you are worse off on Tuesday than on Monday.



29. In the diagram below, the sales tax gives you the red budget line; the head tax gives you the blue. Because it's assumed that both taxes cost you the same amount, the head tax must be set so that the red line passes through the tangency point *P*. Therefore you can reach a higher indifference curve on the blue line, i.e. you prefer the head tax.

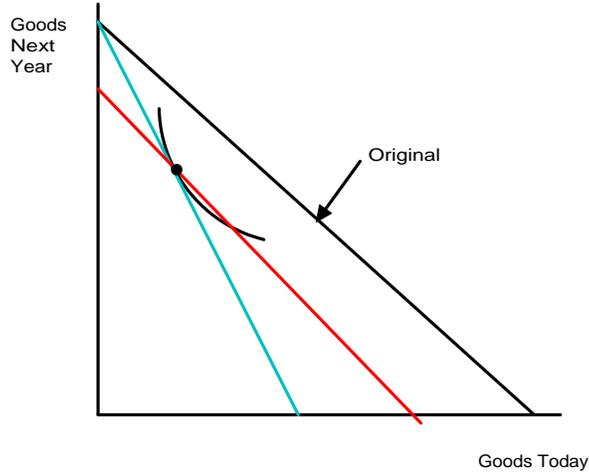


30. You can use exactly the same diagram as in problem 29. Combined sales taxes of 10% on both goods cause your budget line to shift inward parallel to itself, just like a head tax. So you still prefer the blue line (with the combined sales taxes) to the red line (with the sales tax on apples only).

31. The pictures below show the answers to parts b), c) and d). In each case the new budget line is shown in blue and the government's revenue (measured in future dollars) is the length of the red line segment.



32. The temporary sales tax is shown in blue and the permanent sales tax is shown in red. The permanent sales tax is preferred.



33. The next-year-only tax is shown in blue and the permanent tax is shown in red. The permanent tax is preferred.

