∂ 4.5 figure it out

A pizza chain recently offered the following special promotion: "Buy one pizza at full price and get your next three pizzas for just $5 each!" Assume that the full price of a pizza is $10, your daily income $40, and the price of all other goods $1 per unit.

a. Draw budget constraints for pizza and all other goods that reflect your situations both before and during the special promotion. (Put the quantity of pizzas on the horizontal axis.) Indicate the horizontal and vertical intercepts and the slope of the budget constraint.

b. How is this special offer likely to alter your buying behavior?

c. How might your answer to (b) depend on the shape of your indifference curves?

d. Consider the utility functions $U = P^{0.75}G^{0.25}$ and $U = P^{0.25}G^{0.75}$, where P is pizza and G represents other goods. In which case will the promotion more likely lead you to purchase additional pizzas?

Solution:

a. To draw your budget constraint, you need to find the combinations of pizza and all other goods that are available to you before and during the promotion. The starting place for drawing your budget constraint is to find its x- and y-intercepts.

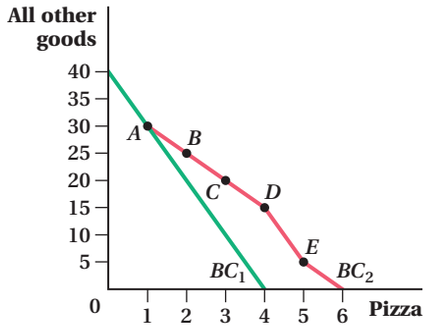
Before the promotion, you could afford 4 pizzas a day ($40/$10) if you spent all of your income on pizza. This is the x-intercept (Figure A). Likewise, you could afford 40 units of all other goods per day ($40/$1) if you purchased no pizza. This is the y-intercept. The budget constraint, shown in Figure A, connects these two points and has a slope of $-40/4 = -10$. This slope measures the amount of other goods you must give up to have an additional pizza. Note that this is also equal to $-P_x/P_y = -\$10/\$1 = -10$.

Once the promotion begins, you can still afford 40 units of all other goods if you buy no pizza. The promotion has an effect only if you buy some pizza. This means the y-intercept of the budget constraint is unchanged by the promotion. Now suppose you buy 1 pizza. In that case, you must pay $10 for the pizza, leaving you $30 for purchasing all other goods. This bundle is point A on the diagram. If you were to buy a second pizza, its price would be only $5. Spending $15 on 2 pizzas would allow you to purchase $25 ($40 − $15) worth of other goods. This corresponds to bundle B. The third and fourth pizzas also cost $5 each. After 3 pizzas, you have $20 left to spend on other goods, and after 4 pizzas, you are left with $15 for other goods. These are points C and D on the diagram.

A fifth pizza will cost you $10 (the full price) because the promotion limits the $5 price to the next 3 pizzas you buy. That means if you choose to buy 5 pizzas, you will spend $35 on pizza and only $5 on other goods, as at bundle E. Now that you have again purchased a pizza at full price, you are eligible to receive the next 3 at the reduced price of $5. Unfortunately, you only have enough income for one more $5 pizza. Therefore, if you would like to spend all of your income on pizza, you can buy 6 pizzas instead of just 4.

As a result of the promotion, then, your x-intercept has moved out to 6, and your budget line has pivoted out (in a somewhat irregular way because of all the relative price changes corresponding to purchasing different numbers of pizzas) to reflect the increase in your purchasing power due to the promotion.

Figure A

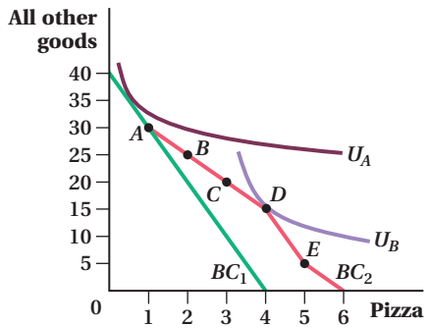


b. It is likely that the promotion will increase how much pizza you consume. Most of the new budget constraint lies to the right of the initial budget constraint, increasing the number of feasible bundles available to you. Because more is preferred to less, it is likely that your optimal consumption bundle will include more pizza than before.

c. If your indifference curves are very flat, you have a strong preference for other goods relative

to pizza. For example, look at U_A (Figure B). The slope of this indifference curve is relatively small (in absolute value). This means that the marginal rate of substitution of other goods for pizza is small. If your indifference curves look like this, you are not very willing to trade other goods for more pizza, and your optimal consumption bundle will likely lie on the section of the new budget constraint that coincides with the initial budget constraint. The promotion would cause no change in your consumption behavior; pizza is not a high priority for you, as indicated by your flat indifference curve.

Figure B



On the other hand, if your indifference curves are steeper, like U_B, your marginal rate of substitution is relatively large, indicating that you are willing to forgo a large amount of other goods to consume an additional pizza. This promotion will more than likely cause you to purchase additional pizzas.

d. The analysis in part (c) suggests that you will be more responsive to the promotion when your marginal rate of substitution is relatively large and less responsive (in terms of purchasing additional pizzas) when your marginal rate of substitution is relatively small. We therefore need to calculate your marginal rate of substitution corresponding to each of the two cases.

For the first case, $MU_P = \frac{\partial U}{\partial P} = 0.75P^{-0.25}G^{0.25}$ and $MU_G = \frac{\partial U}{\partial G} = 0.25P^{0.75}G^{-0.75}$. The marginal rate of substitution therefore is the ratio of these marginal utilities, or $MRS_{PG} = \frac{MU_P}{MU_G}$

$$= \frac{0.75P^{-0.25}G^{0.25}}{0.25P^{0.75}G^{-0.75}} = \frac{3G}{P}.$$

For the second case, $MU_P = \frac{\partial U}{\partial P} = 0.25P^{-0.75}G^{0.75}$ and $MU_G = \frac{\partial U}{\partial G} = 0.75P^{0.25}G^{-0.25}$. The marginal rate of substitution therefore is the ratio of these marginal utilities or $MRS_{PG} = \frac{MU_P}{MU_G}$

$$= \frac{0.25P^{-0.75}G^{0.75}}{0.75P^{0.25}G^{-0.25}} = \frac{G}{3P}.$$

We can therefore see that for any pizza/other goods combination, the first case has a steeper indifference curve and the second case has a relatively flat indifference curve. You are therefore more likely to purchase additional pizza if you have the first utility function.