Budget Constraint and Changes in Prices and Income

Murphy was consuming 80 units of X and 40 units of Y. The price of X rose from 3 to 5. The price of Y remained at 6.

(a) How much would Murphy's income have to rise so that he can still exactly afford 80 units of X and 40 units of Y?

(b) If Murphy's income remains at its original level of \$480, how many units of X can he now afford if the price of X rises to 5 and the price of Y remains at 6, while consuming the same 40 units of Y?

(c) Suppose Murphy's income increases to \$600, but the price of X rises to 5 and the price of Y rises to 7. Can Murphy still afford 80 units of X and 40 units of Y?

(d) If both the price of X and Y increase by 50%, how much would Murphy's income need to increase proportionally to maintain his current consumption of 80 units of X and 40 units of Y?

Solution

(a) Initially, Murphy's income can be calculated as:

$$\text{Income} = (\text{Price of } X) \cdot (\text{Quantity of } X) + (\text{Price of } Y) \cdot (\text{Quantity of } Y)$$

$$\text{Income} = 3 \cdot 80 + 6 \cdot 40 = 240 + 240 = 480$$

After the price of X increases to 5, the new required income to afford the same quantities is:

$$\text{New Income} = 5 \cdot 80 + 6 \cdot 40 = 400 + 240 = 640$$

The increase in income needed is:

$$\text{Increase in Income} = \text{New Income} - \text{Original Income}$$

$$\text{Increase in Income} = 640 - 480 = 160$$

Thus, Murphy's income must rise by:

$$\$160$$

(b) If Murphy's income remains at \$480, the amount spent on Y remains:

$$6 \cdot 40 = 240$$

This leaves:

$$480 - 240 = 240$$

to be spent on X. At the new price of X (\$5 per unit), the number of units of X that can be purchased is:

$$\frac{240}{5} = 48$$

Thus, Murphy can now afford 48 units of X if his income remains at \$480.

(c) With an income of \$600, and the prices of X and Y rising to \$5 and \$7 respectively, the total cost of 80 units of X and 40 units of Y is:

$$80 \cdot 5 + 40 \cdot 7 = 400 + 280 = 680$$

Since Murphy's income is \$600, he cannot afford 80 units of X and 40 units of Y. He falls short by:

$$680 - 600 = \$80$$

(d) If both prices increase by 50%, the new prices are:

$$\text{Price of } X = 3 \cdot 1.5 = 4.5, \quad \text{Price of } Y = 6 \cdot 1.5 = 9$$

The new income required to maintain the same consumption of 80 units of X and 40 units of Y is:

$$80 \cdot 4.5 + 40 \cdot 9 = 360 + 360 = 720$$

The proportional increase in income is:

$$\frac{720}{480} = 1.5$$

Thus, Murphy's income needs to increase by 50% to maintain his current consumption.