Budget constraints

1. Each month, Andy gets the following (exogenous) endowments:

$$\bar{C}_A = 5, \bar{T}_A = 3.$$

Andy can exchange these endowments for currency at market prices, which are exogenous to him, in a central marketplace.

a. If the price of coffee is 7 units of currency per unit of coffee, and the price of tea is 5 units of currency per unit of tea, show why Andy's income/month measured in currency is \$50.00 .

A:

$$\overbrace{5}^{\bar{C}_A} \times \overbrace{7}^{P_C} + \overbrace{3}^{\bar{T}_A} \times \overbrace{5}^{P_T} = 50.$$

b. What is his income/month measured in units of coffee? In units of tea?

A:

$$\frac{50}{7} = 49\frac{1}{7} = 7.\,142\,9; \qquad \text{C/month}$$

$$\frac{50}{5} = 10. \qquad \text{T/month}$$

c. What is the relative price of coffee? What are the units of this price?

A:

$$\frac{P_C}{P_T} = \frac{7}{5} = 1.4$$

The units are units of tea/unit of coffee.

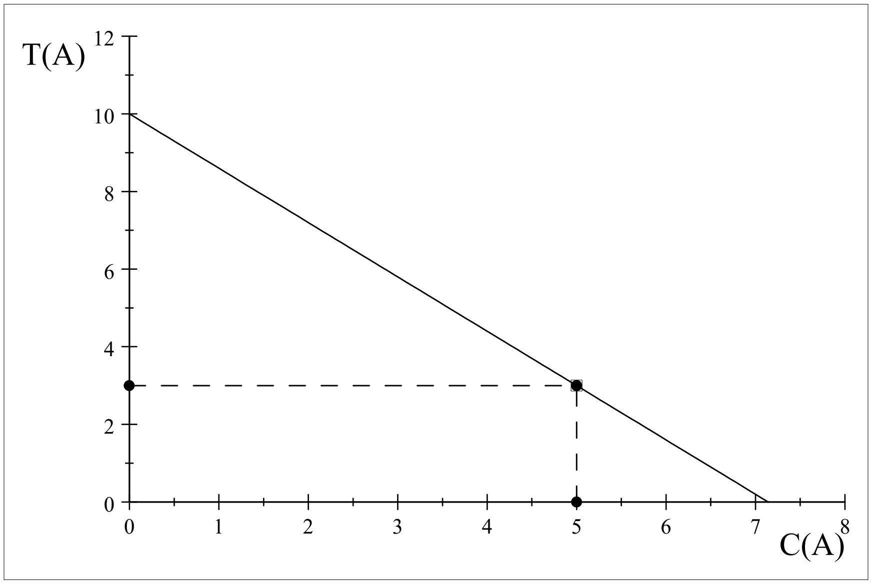
d. Write his budget constraint in standard slope-intercept form with consumption of tea/month on the left-hand-side of the equality sign.

A:

$$T_A = 10 - 1.4C_A.$$

e. With tea on the vertical axis and coffee on the horizontal, draw a schematic diagram of his budget constraint, making sure you identify all relevant features, i.e., slope, intercepts, and endowment point.

A:$y = 10 - 1.4x$. Coffee-intercept is $7.\,142\,9$., endowment point is $(5, 3)$



f. What would happen to this schematic diagram if both P_C and P_T were to double? Triple? Be cut in half?

A: nothing. Both slope and intercept remain unchanged.

2. Now consider another scenario. Andy grows coffee for a living, and takes his harvest to market once a year. There, he can sell as much of his crop as he wants at a market price of a certain amount of dollars per pound of coffee. While at the market, Andy can use the money he gets from selling his coffee to purchase the only other good he likes to consume, tea, at a market price of a certain amount of dollars per pound of tea.

a. Suppose Andy grows 80 pounds of coffee per year, and coffee exchanges in the market place for \$2.00/kilo. Tea exchanges in the market place for \$4.00/kilo. Let C_A symbolize the variable that measures the amount of coffee Andy consumes per year, and T_A symbolize the variable that measures the amount of tea Andy consumes per year. Describe in an equation with only T_A on the left-hand-side of the equality sign all those pairs of kilos of coffee/yr. and kilos of tea/year that Andy could consume at these prices, assuming he spent all of his income.

Answer: Let me put the budget constraint in parametric form. First I express in an equation the equality of income and expenditure:

$$\overbrace{P_C C_A + P_T T_A}^{\textit{Expenditure}} = \overbrace{P_T \overline{T}_A + P_C \overline{C}_A}^{\textit{Income}}.$$

I then rearrange to isolate T_A on the l.h.s. of the equality sign:

$$T_A = \frac{P_C \overline{C}_A}{P_T} + \overline{T}_A - \frac{P_C}{P_T} C_A.$$

Upon substitution of the given values of the exogenous variables:

$$\frac{P_C}{P_T} = \frac{2}{4} = .5; \overline{C}_A = 80;$$
$$T_A = .5 \times 80 - .5C_A;$$
$$T_A = 40 - .5C_A$$

b. Again suppose Andy grows 80 pounds of coffee per year, and again suppose coffee exchanges in the market place for \$2.00/pound, and tea exchanges in the market place for \$4.00/pound. Which of the following amounts of coffee and tea can Andy take home with him from the market place?

i. Ten (10) lbs. of coffee and 35 pounds of tea.

yes: $\overbrace{35}^{T_A} = \overbrace{40}^{\frac{P_C\overline{C}_A}{P_T}+\overline{T}_A} - \overbrace{5}^{.5\times \overbrace{10}^{C_A}}$

ii. 20 pounds of coffee and 30 pounds of tea.

yes: $30 = 40 - 10$

iii. 20 pounds of coffee and 35 pounds of tea.

no: $35 > 40 - 10$

iv. 30 pounds of coffee and 30 pounds of tea.

no: $30 > 40 - 15$

v. 40 pounds of coffee and 20 pounds of tea.

yes: $20 = 40 - 20$

vi. 40 pounds of coffee and 30 pounds of tea.

no: $30 > 40 - 20$

c. What is Andy's income per year measured in units of dollars/year?

A:

$$\overbrace{80}^{\overline{C}_A} \times \overbrace{2}^{P_C} = 160\$/year$$

\$160.

3. Let P_C symbolize the variable that describes the market price of coffee in terms of dollars/pound of coffee, and let P_T symbolize the variable that describes the market price of tea in terms of dollars/pound of tea. Given that Andy produces 80 pounds of coffee per year, describe in an equation using the above symbols all those pairs of pounds of coffee/year (C_A)and pounds of tea/year (T_A) that Andy could consume for arbitrary values of P_C and P_T , assuming he spent all of his income. In this equation, put T_A as the only variable on the left-hand-side of the equality sign.

Answer:

$$T_A = \frac{80P_C}{P_T} - \frac{P_C}{P_T}C_A.$$

4. Let $\overline{C}_A$ symbolize the variable that describes Andy's production of lbs. of coffee per year. For arbitrary values of Andy's production of lbs. of coffee/yr. and arbitrary values of the price of coffee and the price of tea, describe in an equation all those pairs of pounds of coffee/yr. and pounds of tea/yr. that Andy could consume if he spent all of his income. Again, write this equation with T_A as the only variable on the left-hand-side of the equality sign.

Answer:

$$T_A = \frac{P_C}{P_T}\overline{C}_A - \frac{P_C}{P_T}C_A.$$

5. Draw a **schematic** diagram of the above equation in the coffee-tea plane. By coffee-tea plane, we mean the standard picture in which tea/year is measured on the vertical axis and coffee/year on the horizontal axis. By **schematic** we mean that the key qualitative features of the equation, namely the slope and the intercepts, are depicted and identified, although not necessarily to scale.

Answer: slope and intercepts identified, and the line connecting the intercepts arguably a straight line.

6. What would happen to this schematic diagram if both P_C and P_T were to double? Triple? Be cut in half?

A: nothing. Both slope and intercept remain unchanged.