

Economics 101
Spring 2011
Homework #4
Due Tuesday, March 29

Directions: The homework will be collected in a box before the lecture. Staple your homework before handing it in. Please place your name, TA name and section number on top of the homework (legibly). Make sure you write your name as it appears on your ID so that you can receive the correct grade. Please remember the section number for the section you are registered, because you will need that number when you submit exams and homework. Late homework will not be accepted so make plans ahead of time. Please show your work. Good luck!

1. The table below shows the prices and the consumption bundles in 2010 and 2011. Use 2010 as the base year to answer the following questions.

Goods	Quantity in 2010	Price in 2010	Quantity in 2011	Price in 2011
Red Apples	10	\$1	0	\$2
Green Apples	0	\$2	10	\$1

- a. Suppose that the government always takes the consumption bundle in 2010 as the market basket for calculating the CPI. What is the CPI for 2011?

Key: The CPI uses the consumption bundle in 2010 to figure out how much weight to put on the price of a given good:

$$\text{CPI in 2010} = 100$$

$$\text{CPI in 2011} = [(\$2 \cdot 10) + (\$1 \cdot 0)] / [(\$1 \cdot 10) + (\$2 \cdot 0)] \cdot 100 = 200$$

According to the CPI, prices have doubled.

- b. Using the new consumption bundle in 2011, calculate the nominal spending and real spending in 2011 using 2010 as the base year. (Real spending is the total value of the consumption valued at the prices prevailing in the base year.)

Key: In the base year 2010, the real spending equals the nominal spending of \$10. However, in 2011, real spending and nominal spending are different since real spending is calculated using prices from a base year (constant prices) while nominal spending is calculated using prices from the year (current prices). In 2011, the consumption bundle consists of 10 green apples. The price of green apples is \$1 in 2011, while the price of green apples in base year prices (that is, prices from 2010) is \$2. So, we can calculate,

$$\text{Nominal Spending in 2011} = (\$2 \cdot 0) + (\$1 \cdot 10) = \$10$$

$$\text{Real Spending in 2011} = (\$1 \cdot 0) + (\$2 \cdot 10) = \$20$$

Hence, real spending rises from \$10 to \$20.

- c. If Emily only consumes the two goods, and she thinks of red apples and green apples as perfect substitutes, has the cost of living in the economy has changed between 2010 and 2011? Explain your answer.

Key: Since red apples and green apples are perfect substitutes for Emily, in either year

she spends \$10 to consume 10 apples. According to the CPI, however, the cost of living has doubled. This is because the CPI only takes into account the fact that the price of red apples has doubled and ignores the fall in the price of green apples, which were not included in the consumption bundle used to calculate the CPI. Thus, the CPI overstates the increase in the cost of living.

2. The table below lists the CPI, nominal, and real income for five cities. Calculate the missing value for each city, then use the completed table to answer the following questions.

City	CPI	Nominal Income	Real Income
Denver	100	\$50,000	\$50,000
Phoenix	102	\$45,900	\$45,000
Los Angeles	125	\$70,000	\$56,000
New York	210	\$73,500	\$35,000
Dallas	105	\$48,300	\$46,000

- a. In which city would it take approximately \$125 to purchase what \$100 would buy in Denver?

Key: Los Angeles $(\$70,000/\$56,000)*100=125$

- b. How much would you have to earn (nominal income) in New York to have the same real income as you would have with a \$50,000 nominal income in Denver?

Key: In Denver a nominal income of \$50,000 is equivalent to a real income of \$50,000. So, the question is what nominal income in New York will provide a real income of \$50,000 in Denver. Use the formula $\text{real income} = [(\text{nominal income})/(\text{inflation index})] * 100$ to find this answer where the inflation index is the CPI for New York. Thus, $50,000 = [(\text{nominal income})/210]*100$ and nominal income = \$105,500.

- c. How much would you have to earn (nominal income) in Dallas, in order to have the same real income as you would have with a nominal \$70,000 salary in Los Angeles?

Key: In Los Angeles a nominal income of \$70,000 is equivalent to a real income of \$56,000. So, the question is what nominal income in Dallas will provide a real income of \$56,000 in Dallas. Use the formula $\text{real income} = [(\text{nominal income})/(\text{inflation index})] * 100$ to find this answer where the inflation index is the CPI for Dallas. Thus, $56,000 = [(\text{nominal income})/105]*100$ and nominal income = \$58,800.

- d. All else equal, if your boss offered you a 75% raise to move to New York from Phoenix, would you take the job?

Key: New nominal income: $\$45,900*(1+75\%)=\$80,325$

New real income: $\$80,325*(100/210)= \$38,250$

The new real income is less than \$45,000. Thus, it's not a profitable offer.

3. Suppose that labor is paid a constant wage. That is, the firm is a price-taker in the labor market. Please complete the table below given the information provided, and answer the related questions.

Labor	Output	MPL	VC	FC	TC	AVC	AFC	ATC	MC
0	0	----	0	10	10	----	----	----	----
1	1	1	5	10	15	5	10	15	5
2	4	3	10	10	20	2.5	2.5	5	1.67
3	9	5	15	10	25	1.67	1.11	2.78	1
4	12	3	20	10	30	1.67	0.83	2.5	1.67
5	14	2	25	10	35	1.79	0.71	2.5	2.5
6	15	1	30	10	40	2	0.67	2.67	5

- a. At what quantity of output is ATC at its minimum?

Key: ATC is at its minimum when it is equal to marginal cost and that occurs when ATC equals 2.5 and output is equal to 14 units.

- b. At what quantity of output is AVC at its minimum?

Key: AVC is at a minimum when it is equal to marginal cost and that occurs when AVC equals 1.67 and output is equal to 12 units.

- c. Suppose we know that within a certain range of output, ATC is decreasing as output increases. What must be true about ATC and MC? Explain your answer.

Key: MC must be less than ATC if ATC is decreasing as output increases. As production increases the average cost per unit is falling and this is only possible if the additional cost of producing another unit of output (MC) is less than the average cost of producing the output.

4. Suppose that the total short-run cost function of a firm is given by $TC = 200 + 20Q$, where TC is the total cost and Q is the total quantity of output.

- a. What is the firm's fixed cost?

Key: The fixed cost is \$200.

- b. If the firm produces 100 units, what is its average total cost and average variable cost?

Key: The average total cost = $[200 + 20 \times 100] / 100 = \20.2
The average variable cost = \$20

- c. What is the marginal cost per unit produced if the firm is currently producing 100 units and decides to produce one additional unit?

Key: The total cost increases by 20 if the firm produces one more unit. Thus the marginal cost is \$20.

d. Suppose the firm's fixed cost increases by \$50, but its marginal costs fall to \$15 per unit. What is the new total cost equation?

Key: The new fixed cost is $200 + 50 = \$250$, so the y-intercept of the new curve is 250.

The new marginal cost is \$15, so the slope of the new curve is 15.

The new cost equation is $TC = 250 + 15Q$

5. Serida lives in the North of Sparrowshire. Like all other residents of the country, she consumes barley seeds (B) and grilled grasshoppers (G). Sparrowshire was always proud of being able to maintain the low prices for these two goods: barley seeds cost 1 SSD (Sparrowshire Dollars) per ounce, and the grasshoppers are 2 SSD each. Serida is a well known singer in her part of country and earns 100 SSD per month.

a. Draw Serida's budget line on a graph. Put barley seeds on the y-axis and grasshoppers on the x-axis. Mark the numerical value of the y-intercept, x-intercept and the slope. What is the equation of this budget line?

Key: The equation of the budget constraint is $B + 2G = 100$ (B = barley seeds, G = grilled grasshoppers) or in slope intercept form, $B = 100 - 2G$. The y-intercept is 100, the x-intercept is 50, the slope is -2.

b. Serida decides that she wants to have 25 ounces of barley seeds and 40 grasshoppers every month. Is this bundle affordable for her? Does it exhaust her income? What if her choice is 15 ounces of barley seeds and 40 grasshoppers?

Key: The first bundle is not affordable: it costs $25 + 40 \cdot 2 = 105$ SSD, which is more than her income of 100 SSD. The second bundle is affordable but does not exhaust her income: $15 + 2 \cdot 40 = 95 < 100$.

c. Local performers are gradually losing in the competition with recognized international bands, and Serida's income decreases to \$50 while prices are the same as before. What is the equation of this new budget line? How does it compare to the budget line from part (a)?

Key: the new budget constraint is $B + 2G = 50$ or in slope intercept form $B = 50 - 2G$. The new budget line has the same slope as the original budget line but is now closer to the origin: the change in income holding prices constant results in a parallel shift of the budget line.

d. Another world financial crisis reaches Sparrowshire, causing all prices to double from their original levels. What happens to Serida's budget line (assume her income is 100 SSD as before)? How does it compare to the budget line from parts (a) and (c)?

Key: the new budget constraint is $2B + 4G = 100$ or $B = 50 - 2G$. The new budget line is a parallel shift of the original budget line and this new budget line is exactly the same as the budget line in (c).

e. The Duke of Sparrows declares a national campaign promoting the benefits of vegetarian diet. As a result, the price of barley seeds doubles from 1 SSD to 2 SSD per

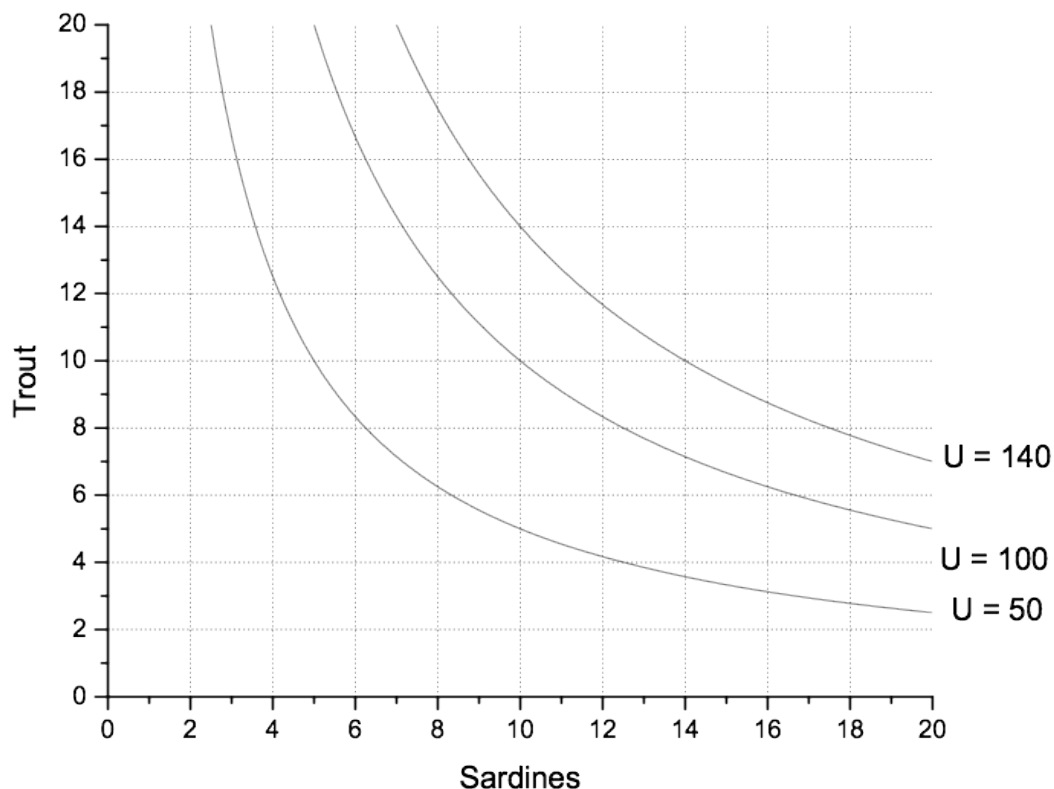
ounce while the price of grasshoppers remains at 2 SSD per grasshopper and Serida's income remains 100 SSD. Draw the new budget line on your graph. What is the new equation for the budget line? How does it compare to the budget line from part (a)?

Key: the new budget constraint is $2B + 2G = 100$ or $B = 50 - G$. The new budget line pivots relative to the budget line in part (a): the two budget lines share the x-intercept but have different y-intercepts.

- f. Serida retires and, trying to avoid unnecessary media attention, becomes very discreet about her income. It is known that the prices of barley seeds and grasshoppers have changed so that now Serida can only consume 60 ounces of barley seeds and 30 grasshoppers with her income. It is known that the price of barley seeds is still 1 SSD, and the price of grasshoppers is 3 SSD. What is Serida's budget constraint after retirement?

Key: The income after retirement is $1 \cdot 60 + 3 \cdot 30 = 150$, so the budget constraint is $B + 3G = 150$ or in slope intercept form $B = 150 - 3G$.

6. Tina derives utility from consumption of sardines (S) and trout (T). The following graph shows her indifference curve map:



- a. If at the utility level $U = 140$ Tina consumes 8 units of trout and decides to increase her consumption of trout by 2 units, how does her consumption of sardines change? [Here

and in the following questions you may round the numbers to the nearest integer if the point on the graph does not seem to be exactly on the grid]

Key: from the graph above, her consumption of sardines decreases by approximately 4 units (from about 18 to 14).

b. If at the utility level $U = 140$ Tina consumes 10 units of trout and decides to increase her consumption of trout by 2 units, how does her consumption of sardines change?

Key: from the graph above, her consumption of sardines decreases by approximately 2 units (from about 14 to 12).

c. As Tina increases her consumption of trout while maintaining the same level of utility, what happens to the amount of sardines she is willing to give up in order to get one more unit of trout? What happens to the slope of the indifference curve, and what is the reason for the change in the slope of indifference curve?

Key: As she increases her consumption of trout while holding her level of utility or satisfaction constant, she is willing to give up fewer sardines to obtain an additional unit of trout. The slope of the indifference curve gets steeper because of diminishing marginal utility from the consumption of trout. (Another way of thinking about this is that as Tina increases her consumption of sardines while holding her utility constant she decreases her consumption of trout-the amount of trout she is willing to give up gets smaller as she gets more and more sardines. From this perspective, ie more sardines, the indifference curve is getting flatter and this flattening is due to the diminishing marginal utility from sardines.)

d. If at the utility level $U = 140$ Tina consumes 10 units of trout and decides to increase her consumption by 2 units of trout while maintaining the level of utility at 140, what is the marginal rate of substitution?

Key: Her marginal rate of substitution can be measured as the change in trout consumption (from 10 to 12) divided by the change in sardines consumption (14 to 12): $MRS = (12-10)/(12-14) = -1$

e. Suppose the price of both trout and sardines is currently \$10, and Tina's income is \$200. Add Tina's budget constraint to the graph.

Key: skip the graph

f. What consumption bundle will maximize Tina's utility given the indifference curve map and the budget constraint from the previous question? What is the marginal rate of substitution at the optimal consumption point?

Key: Tina will choose to consume 10 sardines and 10 trout because this consumption bundle lies on the highest indifference curve she can reach given her income and prices. At this point MRS equals the slope of the budget line, $MRS = -1$.

7. Tony likes nuts (N) and berries (B). He has a monthly income of \$200 to spend on these two goods. The price of nuts stays at \$4 around the year because nuts are so easy to store, but the price of berries varies a lot. Last year the price of berries was \$5 in August; but in December it reached \$8.

a. Write the equations of Tony's budget lines in August and in December. Graph these budget lines (put nuts on the y-axis and berries on the x-axis).

Key: Equation of a budget line in August: $4N + 5B = 200$; equation of a budget line in December: $200 = 4N + 8B$.

b. Being a rational consumer, at August prices Tony purchased 25 nuts. How many berries did he consume in August? What was the marginal rate of substitution at the optimal consumption bundle?

Key: From August budget constraint, $B = 40 - 4/5N = 20$. The marginal rate of substitution equals the ratio of prices of goods, $-5/4$.

c. After three months of price growth, in December Tony consumed 20 nuts. What was his consumption of berries? What kind of goods are berries and nuts for Tony?

Key: From August budget constraint, $B = 25 - 1/2N = 15$. Berries and nuts are complementary goods for Tony.

d. It is known that Tony's demand for berries is linear. Using your answers to questions (b) and (c), derive his demand function.

Key: Find an equation for a line that contains the two points: $P_1 = 5$, $Q_1 = 20$ and $P_2 = 8$, $Q_2 = 15$. The demand equation is $P = 17 - (3/5)Q$.