

Homework 1: Utility and Demand

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- Table 1 presents three scenarios for the utility function $U(x_1, x_2) = x_1^{0.35}x_2^{0.50}$. The scenarios involve three budget constraints.
 - First, $0.75x_1 + x_2 \leq 50$.
 - Second, $0.65x_1 + x_2 \leq 50$.
 - Third, $0.75x_1 + x_2 \leq 60$.
- 1. Using the information in Table 1 to confirm the economic intuition that utility is maximized subject to the budget constraint where

$$\frac{\frac{\Delta U(x_1, x_2)}{\Delta x_1}}{\frac{\Delta U(x_1, x_2)}{\Delta x_2}} = \frac{p_1}{p_2} \quad (1)$$

Note that the rate of change for the utility function can be written as

$$\frac{\Delta U(x_1, x_2)}{\Delta x_1} = 0.35 \frac{x_1^{0.35} x_2^{0.50}}{x_1} \quad (2)$$

and

$$\frac{\Delta U(x_1, x_2)}{\Delta x_2} = 0.50 \frac{x_1^{0.35} x_2^{0.50}}{x_2}. \quad (3)$$

2. Graphically depict the change in the price of p_1 on consumption. Decompose the price change into an income and substitution effect.

Table 1: Consumption Data

Original			Change in Price		Change in Income	
x1	x2	Utility 1	x2	Utility 2	x2	Utility 3
65.0	1.250	4.819	7.750	12.000	11.250	14.458
63.8	2.188	6.332	8.563	12.528	12.188	14.946
62.5	3.125	7.516	9.375	13.018	13.125	15.403
61.3	4.063	8.509	10.188	13.475	14.063	15.831
60.0	5.000	9.372	11.000	13.901	15.000	16.233
58.8	5.938	10.138	11.813	14.300	15.938	16.610
57.5	6.875	10.827	12.625	14.672	16.875	16.963
56.3	7.813	11.453	13.438	15.021	17.813	17.294
55.0	8.750	12.026	14.250	15.347	18.750	17.605
53.8	9.688	12.553	15.063	15.652	19.688	17.895
52.5	10.625	13.038	15.875	15.937	20.625	18.166
51.3	11.563	13.487	16.688	16.203	21.563	18.418
50.0	12.500	13.903	17.500	16.450	22.500	18.652
48.8	13.438	14.287	18.313	16.679	23.438	18.869
47.5	14.375	14.644	19.125	16.891	24.375	19.068
46.3	15.313	14.973	19.938	17.085	25.313	19.251
45.0	16.250	15.277	20.750	17.264	26.250	19.417
43.8	17.188	15.558	21.563	17.426	27.188	19.567
42.5	18.125	15.815	22.375	17.572	28.125	19.701
41.3	19.063	16.050	23.188	17.702	29.063	19.818
40.0	20.000	16.264	24.000	17.817	30.000	19.920
38.8	20.938	16.457	24.813	17.916	30.938	20.005
37.5	21.875	16.630	25.625	17.999	31.875	20.074
36.3	22.813	16.782	26.438	18.066	32.813	20.127
35.0	23.750	16.914	27.250	18.118	33.750	20.163
33.8	24.688	17.027	28.063	18.153	34.688	20.183
32.5	25.625	17.120	28.875	18.173	35.625	20.185
31.3	26.563	17.192	29.688	18.175	36.563	20.170
30.0	27.500	17.245	30.500	18.161	37.500	20.138
28.8	28.438	17.277	31.313	18.129	38.438	20.086
27.5	29.375	17.288	32.125	18.080	39.375	20.016
26.3	30.313	17.279	32.938	18.011	40.313	19.926
25.0	31.250	17.247	33.750	17.923	41.250	19.815
23.8	32.188	17.192	34.563	17.815	42.188	19.682
22.5	33.125	17.114	35.375	17.685	43.125	19.527
21.3	34.063	17.010	36.188	17.533	44.063	19.347
20.0	35.000	16.881	37.000	17.356	45.000	19.141
18.8	35.938	16.723	37.813	17.154	45.938	18.908
17.5	36.875	16.536	38.625	16.924	46.875	18.644
16.3	37.813	16.316	39.438	16.663	47.813	18.347
15.0	38.750	16.061	40.250	16.369	48.750	18.014
13.8	39.688	15.766	41.063	16.037	49.688	17.641
12.5	40.625	15.428	41.875	15.664	50.625	17.223
11.3	41.563	15.040	42.688	15.242	51.563	16.752
10.0	42.500	14.595	43.500	14.765	52.500	16.221

3. Numerically generate the income and substitution effect using the data in Table 1. Note that you will need to compute the utility constant solution for the old price vector. For this computation the relationship

$$U = x_1^\alpha x_2^\beta \Rightarrow x_1 = \frac{U^{1/\alpha}}{x_2^{\beta/\alpha}} \quad (4)$$

will probably be useful.

4. Graphically depict the effect of an increase in income.
5. Numerically determine the income effect using the data in Table 1.
6. Assume that the price of pistachios is \$ 1.15 per pound and that the average consumer eats 15 pounds of pistachios per year. Given an elasticity of demand of -0.15, what would the level of consumption be if the price of pistachios fell to \$ 1.00 per pound.