

# MS-E2191 Homework 2

## Model Solution

September 29, 2021

### Additive value functions

1. The DM states that they feel indifferent between  $(500 \text{ k€} \rightarrow 450 \text{ k€})$  and  $(450 \text{ k€} \rightarrow 300 \text{ k€})$ . Therefore  $v(450) - v(500) = v(300) - v(450)$  and as  $v(300) = 1$  and  $v(500) = 0$  it must be that  $v(450) = 0.5$ . The value function of price is assumed to be linear around the bisection point as shown in Figure 1. Value functions of square footage and location are assumed to be linear between the least and the most preferred levels.

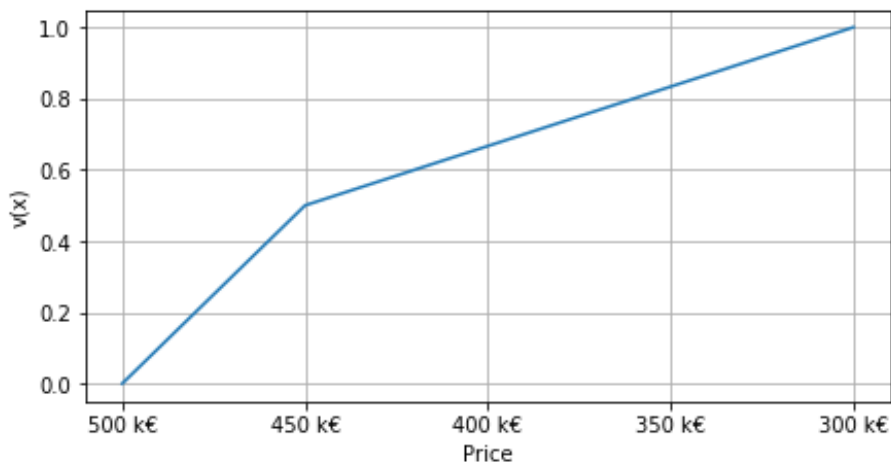


Figure 1: Value function of price.

2. The DM has given the following indifference comparisons:

$$\begin{aligned} (*, 85\text{m}^2, \text{Poor}) &\sim (*, 75\text{m}^2, \text{Excellent}) \\ (450\text{k€}, 65\text{m}^2, *) &\sim (500\text{k€}, 85\text{m}^2, *) \end{aligned}$$

From the definition of additive value function we get the following system of equations:

$$\begin{cases} w_2 v_2(85) + w_3 v_3(\text{Poor}) = w_2 v_2(75) + w_3 v_3(\text{Excellent}) \\ w_1 v_1(450) + w_2 v_2(65) = w_1 v_1(500) + w_2 v_2(85) \\ w_1 + w_2 + w_3 = 1 \end{cases}$$

Now we can solve the attribute weights:

$$\begin{cases} w_1 = 0.4 \\ w_2 = 0.5 \\ w_3 = 0.1 \end{cases}$$

The additive value function score of each alternative is shown in Figure 2 where we can see that alternative **B** is the option considering the DM's preferences.

		Square					
	Price	Footage	Location	$v1(x)$	$v2(x)$	$v3(x)$	$V(X)$
<b>A</b>	300 k€	35 m <sup>2</sup>	Good	1.00	0.00	0.67	0.47
<b>B</b>	350 k€	70 m <sup>2</sup>	Poor	0.83	0.70	0.00	0.68
<b>C</b>	350 k€	45 m <sup>2</sup>	Excellent	0.83	0.20	1.00	0.53
<b>D</b>	450 k€	60 m <sup>2</sup>	Good	0.50	0.50	0.67	0.52
<b>E</b>	500 k€	85 m <sup>2</sup>	Decent	0.00	1.00	0.33	0.53

$w1$	$w2$	$w3$
0.4	0.5	0.1

Figure 2: Value of each alternative.