What is the price elasticity of demand (PED) of sugary foods for teenagers at an online sweet shop located in Stavanger, Norway?

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Economics Extended Essay

Contents

Introduction

In Norway, the proportion of overweight and obese teenagers is at an all-time high, and this disturbing trend continues to rise (Meyer and Vollrath, 2017). This is partly due to consumption of sugary foods increasing among Norwegian teenagers. This increase of consumption of sugary foods has helped lead to approximately 25% of teenagers being overweight or obese in Norway with 17-year-olds having the highest proportion of obese and overweight teenagers in the North and East health regions (Meyer and Vollrath, 2017). Obesity and diabetes amongst youth leads to as respiratory issues, blood pressure , risk of disease and mental issues such as stress and anxiety (Steinnes and Haugrønning, 2020). In order to avoid these consequences, the government could increase the prices to reduce consumption but how efficient is this policy and what are the costs of implementing this policy?

These questions can be answered using the economic theory of price elasticity. Price elasticity is the idea that we can predict how the quantity demanded of a good reacts to a change in price. The elasticity of sugary foods can help determine the necessity of them in teenagers' lives. If I were to determine the degree of necessity of sugary foods in teenagers' lives in Stavanger, it can be used to investigate possible changes in government decisions about the prices of these foods. If the government was able to find out how teenagers would respond to a change in price of sugary foods using the gathered PED, it could change the national prices of sugary foods in order to address the youth health issues or obtain more government revenues.

As a result, I constructed the following research question: **What is the price elasticity of demand (PED) of sugary foods for teenagers at an online sweet shop located in Stavanger, Norway?**

I investigated PED for sugary foods with participants aged from 16-18 who are all currently living in Stavanger, Norway. This age group was selected since it has the highest proportion of obese and

overweight teenagers in Norway. I created a store simulation where I sold sugary foods along with some other goods to test the elasticity of them. I gave participants a fixed income and made them buy from this store over a month period. I consistently changed the price of the items in intervals to see how that affected how much they bought with their fixed income. All changes in price and quantity demanded were recorded to derive demand curves and calculate the PED. As a result, conclusions were drawn based off the gathered PED values. In order to understand the conclusions drawn, the theory of PED must be understood.

Theory

PED is the measure of how responsive the quantity demanded by consumers is to a change in price (Tragakes, 2020 pp.85). PED measures how much the quantity demanded increases from a decrease in price or vice versa. It can be used to discover the responsiveness of teenagers' quantity demanded of sugary foods if the government were to introduce policies to manipulate the price.

In order to calculate PED, the percentage change in quantity demanded (Qd) is divided by the percentage change in price (P) (Tragakes, 2020 pp.85-86). The value received would always be negative since either the change in Qd or P would be negative. Therefore, it is written with no sign and is given a value from 0 to 1 .

$$PED = \frac{\%\Delta \mathrm{Qd}}{\%\Delta \mathrm{P}}$$

If the PED value is greater than 1, it means that the demand for the good is elastic (Tragakes, 2020 pp.87-88). This means that the Qd of consumers is highly responsive to a change in price. Examples of goods with elastic PED would be luxury cars and branded clothing. If the PED value is smaller than 1, it means that the demand for the good is inelastic. This means that Qd of consumers is barely responsive to a change in price. This is common for necessities such as salt, gas, or medical supplies.

There are four factors which determine PED (Tragakes, 2020 pp.91-92). The first determinant of PED is the number of close substitutes. The higher the number of close substitutes, the more elastic the demand of the good becomes. For example, if the price of the KitKat bar increased, the Qd will decrease greatly since the consumers can choose from the other cheaper chocolate bars.

The degree of necessity is another determinant of PED. Necessities, such as bread or medicine, need to be purchased because they are required to survive. Hence, the price does not really affect the Qd because consumers need it and will buy it no matter the price. Thus, necessities have inelastic demand

whilst luxury goods, such as cars or diamond rings, have elastic demand. Luxury goods are not required to survive, and consumers will react more to a change in price. The necessity of sugary foods can vary. Teenagers may consider them essential in their lives making the demand for sugary foods more inelastic.

The proportion of income spent on a good is another determinant of PED. The greater the proportion of income spent on a good, the more elastic the demand becomes because a change in price represents a large expenditure for the consumer. Therefore, houses and cars have price elastic demand. However, goods such as bread or milk take relatively small percentage of a consumer's income and therefore, the demand is inelastic because consumers are not bothered by a change in price. The proportion of income spent on sugary foods by students can vary affecting their PED.

The final determinant of PED is time. The more time consumers receive for making decisions about a good, the more elastic the demand becomes because consumers will find more choices and substitutes. For example, if the price of gas increases, people will eventually begin moving to electric cars or begin taking public transport if they have time. Hence, gas has price inelastic demand in the short term, but the demand becomes more elastic in the long term.

Using this information, they can tax a specific good for their national goals.

Figure 1.1: Tax placed on a good with inelastic demand

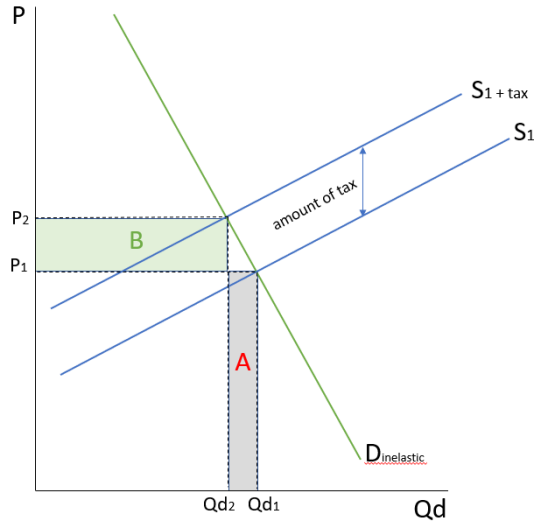
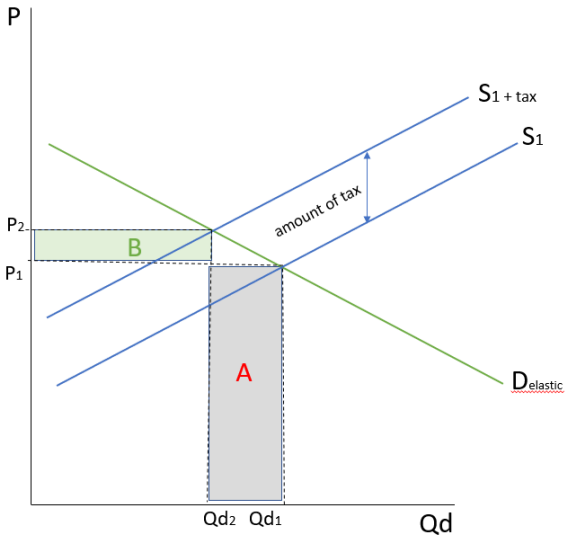


Figure 1.2: Tax placed on a good with elastic demand



The government can place an indirect tax which is a tax levied on a good. Due to the indirect tax, the cost of production increases for producers making it more difficult to supply. Therefore, the supply decreases (S1→S1+tax) (Tragakes, 2020 pp.129). The distance between the supply curves is the amount of tax. The boxes A and B are total revenue(TR) boxes for the government. TR is the price multiplied by the quantity which is the total money gained by the government.

In Figure 1.1, we can see that the demand is relatively inelastic and in Figure 1.2, we can see that the demand is relatively elastic (Tragakes, 2020 pp.93-95). When both goods are taxed, TR box A is lost but TR box B is gained. The government will gain revenues if they tax the inelastic good and would lose revenues if they tax an elastic good because TR box B is larger than TR box A for inelastic whilst the opposite occurs for elastic. Thus, inelastic goods should be taxed for higher government revenues whilst elastic goods should not (Khan Academy, n.d.). However, the Qd does not drop as much as for the good with inelastic demand as it does for the good with elastic demand. If the

government wanted to decrease the consumption of a good , the elastic good should then be taxed to decrease Qd despite a loss of government revenues. This decision should be based on the national goals.

Data Collection

The original idea was to create a physical store to test the PED of goods which may have led to more accurate results applicable to a real-life context if they were to buy real products with their own money. However, the Corona situation made that idea impractical leading me to the idea of creating an online store simulation instead.

Firstly, I gathered ideas of goods I would sell at my online store simulation. I decided I would include necessities and luxury goods along with the sugary foods because that would better simulate a real shopping experience and I can use the PED values I calculate for those goods to compare to the elasticity of the sugary foods and existing theory. I decided I will have eight sugary foods , four necessity goods and five luxury goods. These numbers allow for approximation of an actual shopping experience and sufficiency in the data. I needed to select these goods so that there is variety, local availability and are goods commonly bought by teenagers. Hence, I went around stores and visited local websites to gather goods which fit the descriptions of a necessity, sugary food, or a luxury good. I also used personal knowledge, being a teenager myself, for what type of foods teenagers would be buying. For example, a high-end piece of art would not be as relevant to teenagers as a pair of fashionable shoes. Using the help of online sources, physical stores, and my personal knowledge, I was able to gather a list of goods to sell at my simulation store (*see Appendix 1.1 for goods*).

I gathered price data from real life grocery stores for necessities and sugary foods by visiting the following stores: Kiwi, Coop Mega and Rema 1000 (*see Appendix 1.2 for physical evidence*). I gathered prices for luxury goods online because most products were not available in local stores. I then gathered the averages of all the prices I collected to use as my store prices before I changed them (*see Appendix 1.1 for gathered prices and averages*).

After selecting goods and gathering prices, I created my online store. I used the program Crowdsignal to create an online store with images and their prices with an introduction at the top (*see Appendix 2.1 for online store simulation preview and 2.2 for evidence of creation*).

Before beginning to collect data and change prices, a few more decisions needed to be made.

- What income would I give them?

I found out the average income for a 17-year-old in Norway in 2015 yearly is 29,000kr a year (Epland, 2017). This value is relevant since the majority of my participants are aged 17. As I was using a month time period to collect my data, I decided to use the monthly value of 2400kr for the participants income.

- How often should I change the prices?

Every three days seemed sufficient because it would allow me to gather enough data to be collected in a month. If the interval were fewer days, it may become too dull for the participants to participate in the store since they would have to do it in a near daily basis leading to rushed results. However, spacing it out more would allow for the participants to have more time to think about their decisions.

- How am I going to change the prices?

Since I am changing the price every three days for approximately a month, each participant will be visiting my shop ten times. Of those ten times, I will spend six of those visits increasing/decreasing price of sugary foods and two visits each for necessities and luxury good. This is because the luxury goods and necessities in the shop are only used for comparison whilst the elasticity of the sugary foods is the primary focus. I decided not to change prices of more than one category at a time. I will increase and decrease the sugary foods prices by 15%, 30% and 45% and do 30% increase/decrease for luxury goods and necessities. This allows for sufficient changes in price for me to find out the PED and construct demand curves.

I then created a social media group with all participants to share the links to the store simulation and for them to ask me questions. I gave them a new link every time I changed the prices. *See Appendix 2.3 for evidence of social media group*

I gathered the following data:

Figure 2: Quantity demanded of goods sold at my online simulation affected by a change of price (see Appendix 4 for expanded version)

EE Quantity Demanded + Price Data

	19/4 - 22/4		22/4 - 26/4		26/4 - 29/4		29/4 - 3/5		3/5 - 6/5		6/5 - 10/5		10/5 - 13/5		13/5 - 17/5		17/5 - 20/5		20/5 - 24/5		24/5 - 29/5	
	Price:	Qd:	Price:	Qd:	Price:	Qd:	Price:	Qd:	Price:	Qd:	Price:	Qd:	Price:	Qd:	Price:	Qd:	Price:	Qd:	Price:	Qd:	Price:	Qd:
Monster energy drink (0,5L) /+2kr pant	22.06(+2)	19	**25.37(+2)**	*17*	**28.68(+2)**	12	**31.99(+2)**	8	22.06(+2)	30(+15)	22.06(+2)	10	**18.75(+2)**	27	**15.44(+2)**	30 (+30)	**12.13(+2)**	37	22.06(+2)	38	22.06(+2)	4
Caprisun (10pk)	97.5	25	**112.13**	*20*	**126.75**	17	**141.38**	10	97.5	45	97.5	19(+10)	**82.88**	25	**68.25**	29(+15)	**53.63**	38(+30)	97.5	49	97.5	20
Smash chocolate (200g)	37.3	36	**42.9**	*24*	**48.49**	19	**54.09**	17	37.3	23	37.3	12	**31.71**	22	**26.11**	26(+15)	**20.52**	50	37.3	20	37.3	13
Daim bar (56g)	18.1	26	**20.82**	*18*	**23.53**	15	**26.25**	13(+10)	18.1	20(+10)	18.1	7	**15.39**	29(+15)	**12.67**	31(+30)	**9.96**	39	18.1	26(+15)	18.1	20
Extra gum (10pk)	13.77	22	**15.84**	*16*	**17.9**	10(+15)	**19.97**	8	13.77	36(+15)	13.77	23(+10)	**11.7**	26	**9.64**	33(+45)	**7.57**	45(+30)	13.77	24(+15)	13.77	18
Royal ice cream bar (73g)	28.3	14	**32.55**	*12(+10)*	**36.79**	9	**41.04**	7	28.3	30	28.3	8	**24.1**	15	**19.81**	17(+30)	**15.57**	20	28.3	10	28.3	9
Fruit skittles (174g)	30.5	32	**35.08**	*26*	**39.65**	22(+15)	**44.23**	15	30.5	29(+15)	30.5	15(+15)	**25.93**	23	**21.35**	19(+15)	**16.78**	37(+15)	30.5	17(+15)	30.5	20(+15)
Freia milk chocolate plate (200g)	36.9	22	**42.44**	*11*	**47.97**	8 (+20)	**53.51**	6	36.9	31	36.9	9	**31.37**	24	**25.83**	29 (+15)	**20.3**	36	36.9	19	36.9	9
Gourmetloff bread (520g)	35.13	36 (+30)	35.13	44	35.13	33(+15)	35.13	42	35.13	45	35.13	53(+14)	35.13	52	35.13	53	35.13	44(+15)	**45.67**	30	**24.59**	45
Tine Helmelk (3.5% fat 1L)	19.97	43	19.97	42	19.97	39	19.97	49	19.97	37	19.97	34	19.97	32	19.97	30	19.97	40	**25.88**	33	**13.98**	50(+15)
Frokost eggs (12pk)	39.9	25	39.9	20	39.9	19	39.9	16	39.9	26	39.9	18	39.9	19	39.9	15	39.9	22	**51.87**	21	**27.93**	28
Norvegia sliced cheese (300g)	38.4	25	38.4	17	38.4	15	38.4	18	38.4	34	38.4	10	38.4	18	38.4	15	38.4	21(+15)	**49.92**	18	**26.88**	23
Air Force 1s (07')	979	9	979	10	979	4	979	9	**1272.7**	3	**685.3**	12	979	6	979	3	979	4	979	6	979	5
Airpods (2nd Gen)	1349	8	1349	1	1349	5	1349	5	**1753.7**	2	**944.3**	10	1349	2	1349	3	1349	2	1349	1	1349	1
Nintendo Switch (Lite)	2269	3	2269	3	2269	0	2269	2	**2949.7**	0	**1588.3**	8	2269	1	2269	2	2269	2	2269	2	2269	5
Tommy Hilfiger watch (gold plated)	1726	1	1726	1	1726	4	1726	3	**2243.8**	2	**1208.2**	2	1726	2	1726	1	1726	1	1726	1	1726	2
Ray-Ban RB2140 Original Wayfarer Classi	930	6	930	6	930	4	930	6	**1209**	4	**651**	7	930	6	930	5	930	4	930	6	930	7
	NORMAL		**15% increase**		**30% increase**		**45% increase**		**30% increase**		**30% decrease**		**15% decrease**		**30% decrease**		**45% decrease**		**30% increase**		**30% decrease**	
	base data		**Sugary foods**		**Sugary foods**		**Sugary foods**		**Luxury goods**		**Luxury goods**		**Sugary foods**		**Sugary foods**		**Sugary foods**		**Neccessities**		**Neccessities**	
	28 consumers		26 consumers		27 consumers		25 consumers		26 consumers		25 consumers		23 consumers		22 consumers		22 consumers		23 consumers		22 consumers	

All new prices were always rounded to 2 decimal points because that is how they are shown in stores. The blue set of data is the base data which had the calculated prices from *Appendix 1.1* and had no changes in price. This is the data I will be comparing to the rest of my results when I begin changing the prices. The yellow highlighted data are the Qd values resulting from a change in price. The category of goods, number of participants during that 3-day interval and the %Δ in price is mentioned below the price columns. The bold prices are the changed prices. The number of consumers who participated decreased throughout the shopping simulation process which is important to note when analyzing the data. The red values are outliers collected in the data which is a value more than 1.5 multiplied by the next highest Qd value for that good. A new link was sent every interval (three days) in the social media group chat.

I also created a survey to collect qualitative data as well (*see Appendix 3 for qualitative survey*) . This survey was created to look into the determinants of PED and for evaluation purposes. I sent the link to the survey after the shopping simulation was over. I collected the results. See Appendix 5 for qualitative results which are addressed later.

Data Analysis

Since we are not looking at specific goods but rather the categories of them, we can gather the total Qd for each category at each change in price. We can then use the percentage changes in these Qd values to calculate the PED. However, there were several outliers within the raw data in Figure 2 and therefore, I created tables excluding and including the outliers to determine if they should be considered in the PED calculations.

Figure 3.1: Tables of total quantity demanded excluding outliers from the raw data in Figure 2

Sugary foods

Price change(%)	**Total Qd**
Base	196
+15	144
+30	112
+45	84
-15	191
-30	214
-45	302

Necessities

Price change(%)	**Total Qd**
Base	129
+30	102
-30	120

Luxury Goods

Price change(%)	Total Qd
Base	27
+30	11
-30	39

Figure 3.2: Tables of total quantity demanded including outliers from the raw data in Figure 2

Sugary foods

Price change(%)	Total Qd
Base	196
+15	154
+30	162
+45	94
-15	206
-30	409
-45	377

Necessities

Price change(%)	Total Qd
Base	129
+30	102
-30	135

Luxury Goods

Price change(%)	Total Qd
Base	27
+30	11
-30	39

We can see that the inclusion of outliers makes the data inconsistent and leads to results which do not make sense. For example, the Qd increases when the prices of sugary foods increase from 15% to 30% which goes against the theory since there is a larger Qd when P increased. In addition, it gave an extreme value of 409 when sugary food prices decreased by 30% which was nearly double the value without outliers. Due to inconsistency and inaccuracy, the data will no longer consider outliers for making calculations.

Furthermore, the number of consumers decreased throughout the shopping process and that affected the Qd. For example, it may seem that a decrease of sugary food prices by 15% led to less Qd in Figure 3.1 but it was rather due to fewer participants during that interval. Therefore, I had to take the total Qd and divide it by the number of participants to gain the average Qd for each change in price.

Figure 4: Average quantity demanded for each type of good using data from Figure 2 and Figure 3.1

Sugary foods

Price change(%)	**Average Qd** (rounded to 2 decimal points)
Base	7
+15	5.54
+30	4.14
+45	3.36
-15	8.3
-30	9.73
-45	13.73

Necessities

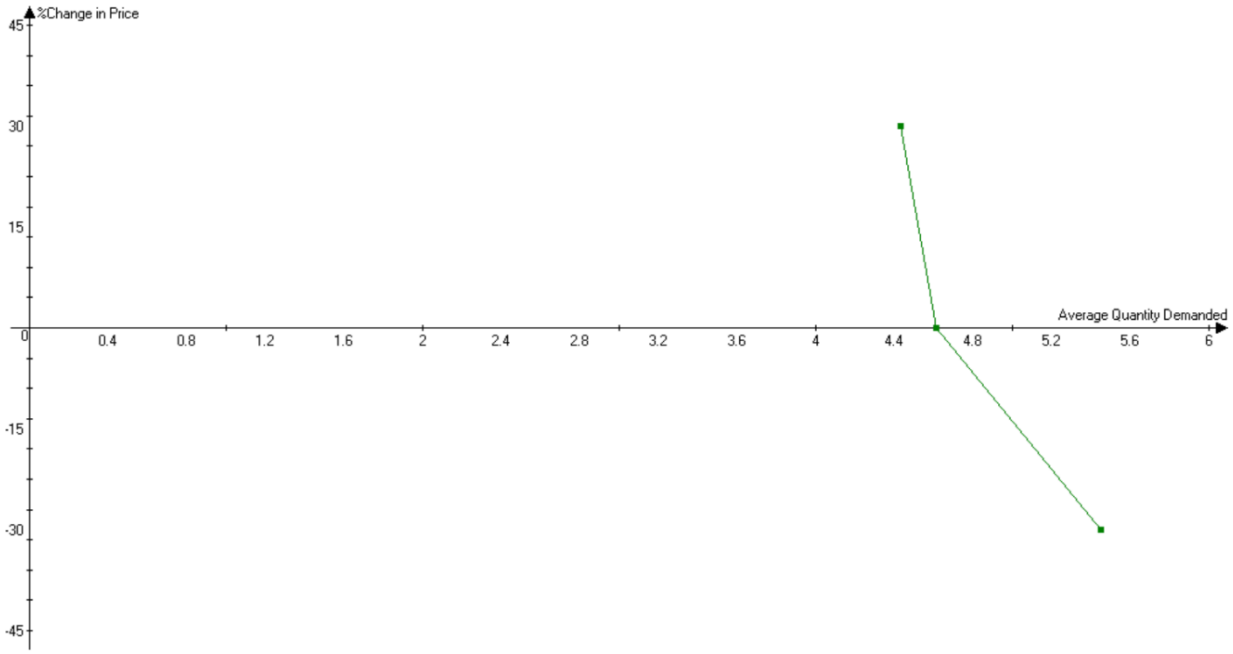
Price change(%)	**Average Qd**
Base	4.61
+30	4.43
-30	5.45

Luxury Goods

Price change(%)	**Average Qd**
Base	0.96
+30	0.42
-30	1.56

I then used these average values to graph demand curves and to calculate PED values of the various parts of the demand curve using the formula of $\frac{\%\Delta Qd}{\%\Delta P}$ and calculate percentage changes using the formula $\frac{\text{new}-\text{original}}{\text{original}} * 100$.

Figure 5.1 Demand curve of necessities constructed from the values of Figure 4



Graphs composed using Alentums advanced grapher (2021).

Figure 5.2 Calculated PED of necessities using the values of Figure 4

	Between 0% and 30% Change in P	**Between 0% and -30% Change in P**
%change in average Qd	-3.9	18.22
%change in P	30	-30
PED	0.13	0.607
Elasticity	**Inelastic (PED < 1)**	**Inelastic (PED < 1)**

Figure 6.1 Demand curve of luxury goods constructed from the values of Figure 4

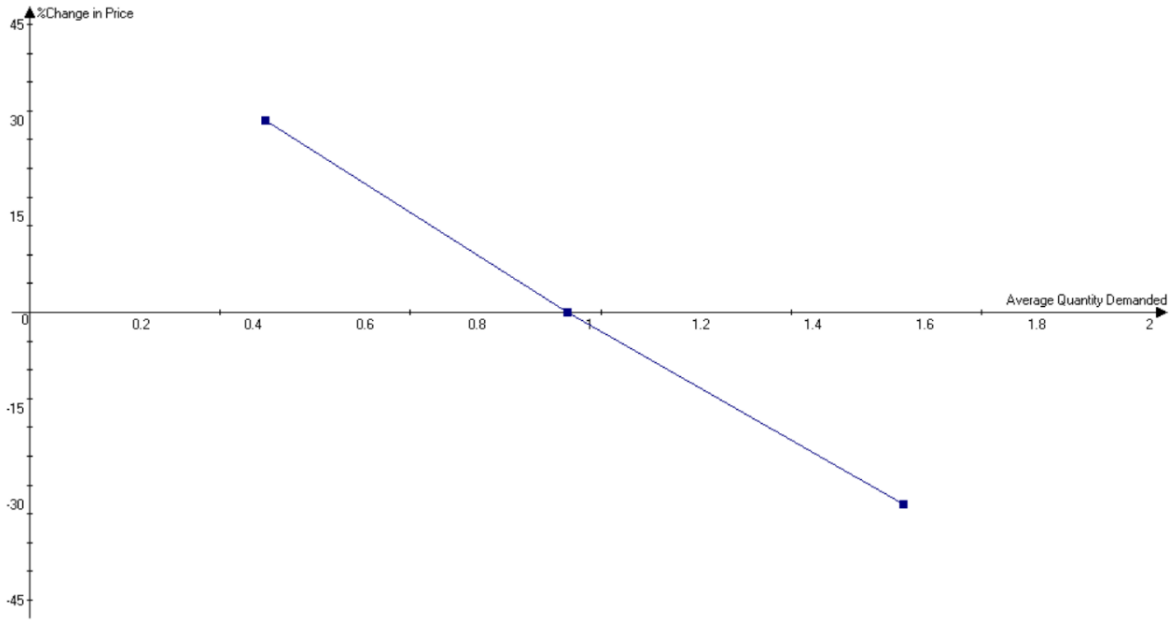


Figure 6.2 Calculated PED of luxury goods using the values of Figure 4

	Between 0% and 30% Change in P	**Between 0% and -30% Change in P**
%change in average Qd	-56.25	62.5
%change in P	30	-30
PED	1.875	2.08
Elasticity	**Elastic (PED > 1)**	**Elastic (PED > 1)**

We can see from Figures 5.1 and 5.2 that the demand for the necessities was inelastic in my simulation since an increase and a decrease of 30% in price yielded a PED below 1. Furthermore, in the qualitative survey, 89.5% of participants considered the necessity goods in the simulation essential to their daily lives (*see Appendix 5 Question 4*) and found that necessities do not require a large portion of their income and that they were always able to afford them despite a change of price (*see Appendix 5 Question 8*) supporting the inelastic demand curve. This confirms the theory since necessity goods should have low elasticity due to them being required to be bought in order to survive and taking up a low proportion of their income. The participants provided the same reasoning.

Looking at Figure 6.1 and 6.2, we can see that the demand for the luxury goods was highly elastic since both an increase and decrease of 30% yielded a PED above 1. In the qualitative survey, 84.2% of participants believed that the luxury goods in the simulation were not necessary in their daily lives (*see Appendix 5 Question 3*) supporting the elastic demand curve. In addition, participants believed that the luxury goods took up the largest proportion of their income and that they were better able to afford them with a decrease in price (*see Appendix 5 Question 7*) . This again confirms the theory because luxury goods should have price elastic demand due to the fact that they are not necessary and take up a large proportion of a consumer's income. The participants provided the same reasoning. Luxury goods also have several substitutes but that was beyond the scope of investigation but would make for interesting research.

Therefore, my simulation presents a degree of accuracy since it was able to produce data confirming the existing theory about necessities and luxury goods.

Figure 7.1 Demand curve of sugary foods constructed from the values of Figure 4

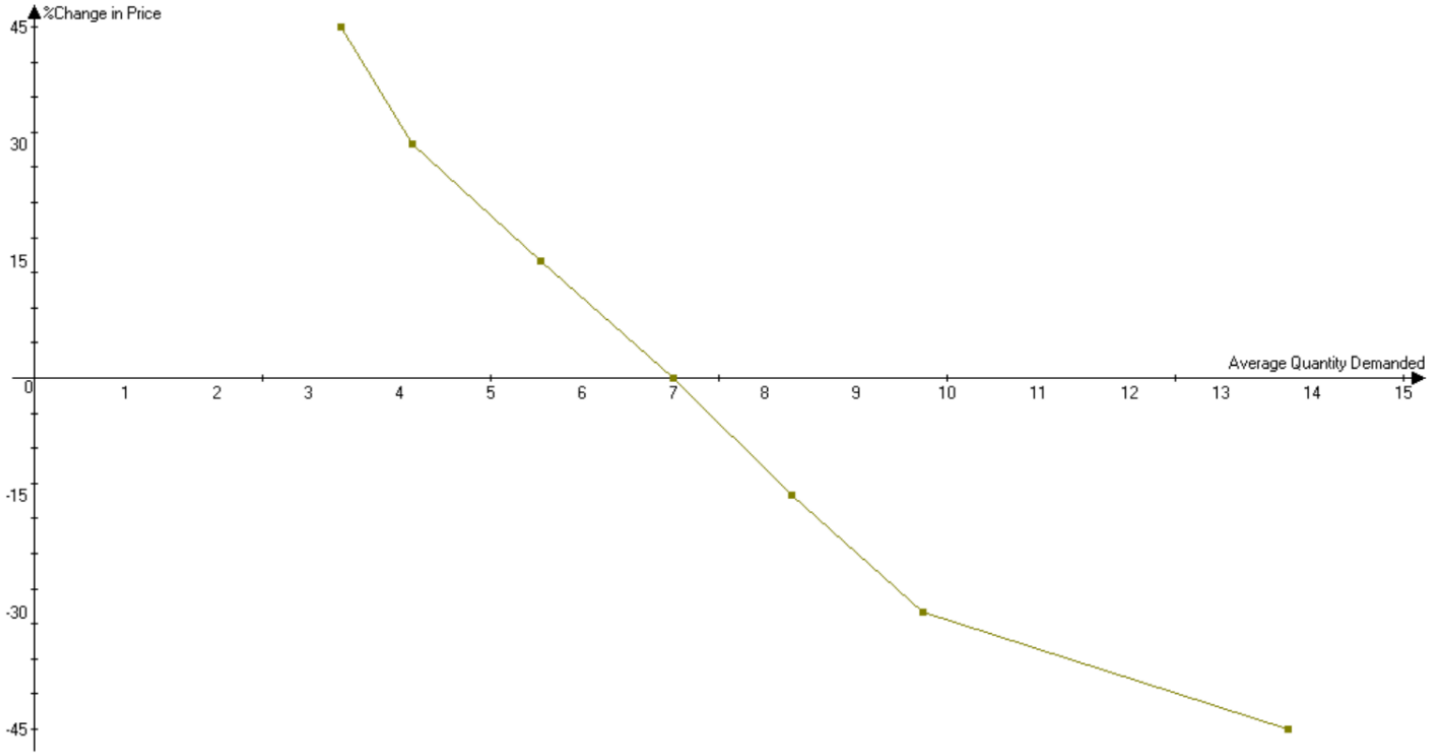


Figure 7.2 Calculated PED of necessities using the values of Figure 4

	Between 0% and 15% Change in P	**Between 15% and 30% Change in P**	**Between 30% and 45% Change in P**	**Between 0% and -15% Change in P**	**Between -15% and -30% Change in P**	**Between -30% and -45% Change in P**
%change in average Qd	-20.86	-25.27	-18.84	18.85	17.22	41.11
%change in P	15	15	15	-15	-15	-15
PED	1.39	1.68	1.26	1.26	1.15	2.74
Elasticity	**Elastic (PED > 1)**	**Elastic (PED > 1)**	**Elastic (PED > 1)**	**Elastic (PED > 1)**	**Elastic (PED > 1)**	**Elastic (PED > 1)**

I concluded that the demand for sugary foods by consumers in my simulation was elastic. This can be deduced since all parts of the demand curve have a PED value above 1. A high percentage of participants stated that changes in prices significantly affected how much they bought (*see Appendix 5 Question 2*) providing evidence that the demand for sugary foods was elastic.

I looked closer at the determinants of PED to find out why the demand for sugary foods is elastic among teenagers. Firstly, the participants believed that sugary foods did not have a high degree of necessity. This is seen when participants rated the necessity sugary foods out of 10 and 73.7% of participants rated the necessity below 5 (*see Appendix 5 Question 1*). The degree of necessity was not high for the teenage consumers and therefore, the good became more elastic because it did not seem like a requirement to buy. However, it was often stated that the sugary foods did not take up a large proportion of their income which should make the demand for sugary foods more inelastic according to the theory but is not evidenced by calculated PED values. However, the PED values of sugary foods are not as high as the luxury goods PED on average and therefore, can be due to the fact that sugary foods do not represent a large proportion of the teenagers' income. The time period of three days was generally perceived to be appropriate, but some found it quite long. This also supports the elastic demand because the longer the time period, the more long-term choices the consumers have according meaning that the demand for the good becomes more elastic. These are all probable reasons behind the elastic demand for sugary foods.

Acknowledging the elastic demand for sugary foods and that Stavanger teenagers do not consider them a necessity; we can see that the government shouldn't tax sugary foods to increase their prices if the goal is to gain more revenues because they will lose revenues if they tax a good with elastic demand. However, if it taxes goods with elastic PED, the Qd decreases greatly with an increase in price and the government can then slightly increase the price with indirect tax to significantly decrease the Qd and thus, the consumption of sugary foods. Despite a loss in revenues, this would increase the health among

youth all around Norway since there would be less consumption of sugary foods leading to less risk of diseases, less obesity, less teeth decay, and decreased stress (Richards and Hatanaka, 2020).If the demand for sugary foods was determined to be elastic all around Norway, the price manipulation by the government may lead to better health nationwide which may allow for the government to decrease expenditure on healthcare to save revenues. This simulation provides a sample size which can be used to reach conclusions about Norwegian teenagers nationwide. If the conclusions from this simulation were to be proved on a larger scale, government decisions about the price of sugary foods can change based on the national goals.

Evaluation

The validity of the conclusions drawn will depend on the validity of the testing and the data which must be evaluated.

The testing process included several outliers seen in Figure 2. This means that the data was highly variable meaning a large difference in consumer decisions which may make the data chosen less valid because it did not apply to all participants. In addition, participants found that the data was quite repetitive and dull (*see Appendix 5 Question 9*) and therefore, participants did not take it seriously throughout the whole process which means they could have made consumer decisions which they may not have made in a real-life context. That is a limitation that comes with an online simulation instead of a real-life store. The lack of seriousness in participation may have led to data going against the theory (*orange highlighted data in Figure 2*) where a decrease in price led to a decrease in Qd or vice versa. This could affect the accuracy of the conclusions drawn because it worsens the simulation's ability to apply to a real-life context. This repetitiveness also may have been the reason behind the decrease in consumer participation throughout the simulation period (*see Figure 2*). This decrease in participation makes the conclusions drawn less valid because the Qd of the missing participants may have affected the PED values. Furthermore, the conclusions are mostly only applicable in a local context since I only had around 30 people and tested for only around a month. In order to be more applicable and valid, I should have collected participants from all over the country and for a longer testing period.

However, the testing period and number of participants was sufficient enough to get a sample size which I could analyze in depth with several calculated values and graphs allowing me to reach detailed conclusions. As well as that, there was detailed preparation which led to the testing considering many factors which could affect the simulation such as income , methods of testing and determinants. However, it is important to note that the income was not real and if I gave them real money, the buying

decisions would most likely change. Despite the fact that were outliers, these were well considered within the analysis before they were decided to be excluded. Furthermore, the data gathered on the necessities and luxury goods reached accurate conclusions because it was similar to the existing economic theory. This would assure some accuracy in the data and conclusions drawn about sugary foods. This research also considered both quantitative and qualitative data allowing for detailed conclusions to be drawn.

Overall, despite outliers and lack of seriousness of the participants, there was sufficiency in the data, in depth analysis and considerate testing which allowed for valid conclusions to be drawn from this experiment.

Conclusion

In order to find out the PED of sugary foods for teenagers, I developed a simulation store which I used to collect data on responses of quantity demanded to change in price of sugary, luxury and necessity goods. This data was then analyzed to discover the elasticity of sugary foods. Responding to the question "**what is the price elasticity of demand (PED) of sugary foods for teenagers at an online sweet shop located in Stavanger, Norway**?" I conclude that the PED of sugary foods for teenage participants in my online store is elastic.

Acknowledging that the PED for sugary foods is possibly elastic and that teenagers don't consider them a necessity, the government can manipulate the price of them in accordance with their own national goals. However, despite detailed testing and analysis, this research remains yet a sample and cannot be applied on a national scale since it doesn't incorporate important factors such as substitutes for the goods, another determinant of PED, which would make for another interesting study.

How the conclusion of this research applies to teenagers across the city, country and world is well beyond the scope of my investigation but would make for interesting and significant research.

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Appendices

Appendix 1.1

EE PRICES FOR SHOP SIMULATOR

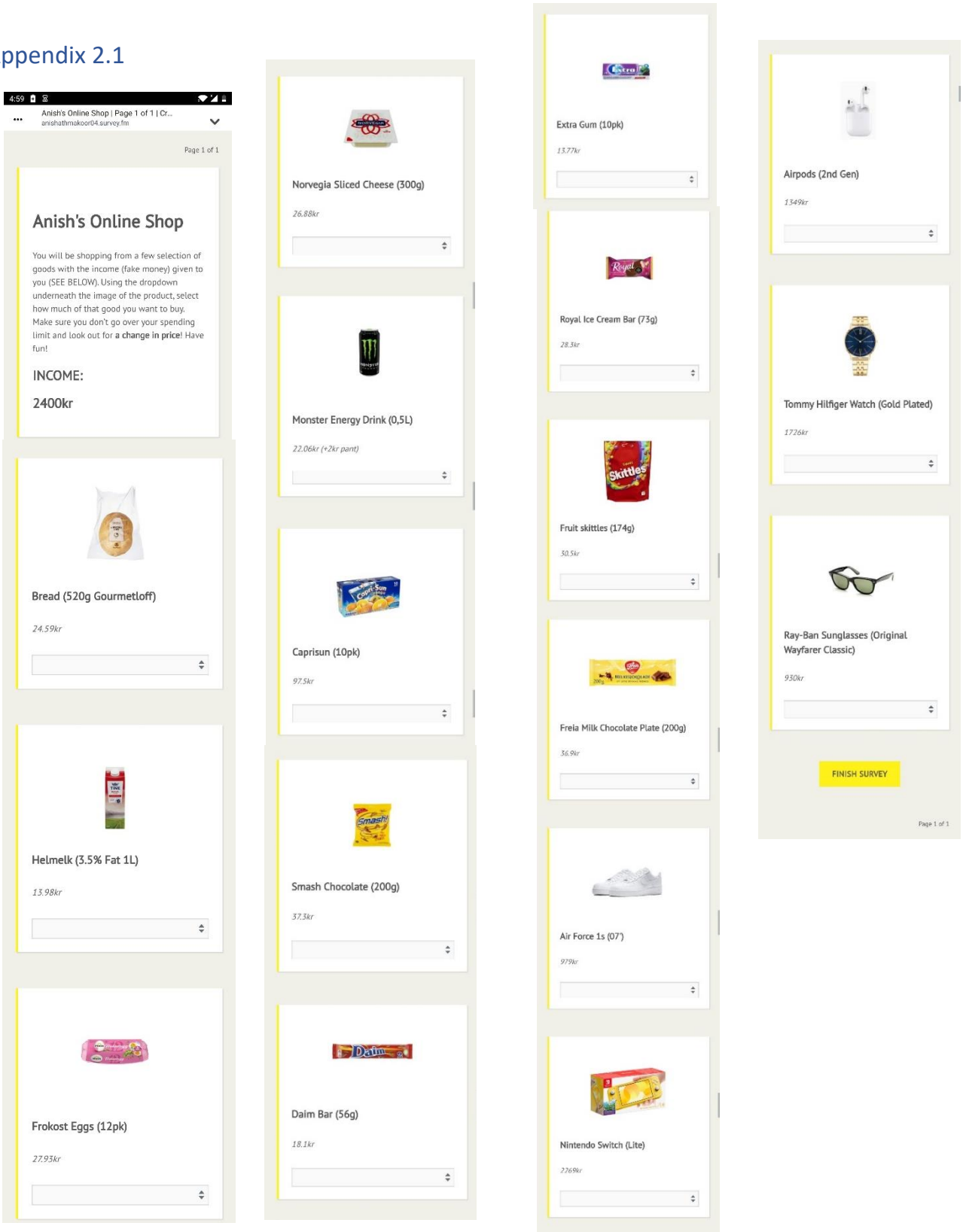
	Product:	Kiwi Price(kr):	Rema 1000 Price(kr):	Coop Price(kr):	*Average(kr):*		orange number=
Sugary foods	Monster energy drink (0,5L) /+2kr pant	22.9	22.9	20.4	22.06666667	(+2kr pant)	not exact same type of product
	Caprisun (10pk)	102(found online)	90	105	97.5		
	Smash chocolate (200g)	32.9	37.9	41.1	37.3		
	Daim bar (56g)	17.4	17.4	19.5	18.1		
	Extra gum (10pk)	12.9	13.9	14.5	13.76666667		
	Royal ice cream bar (73g)	27.9	28	29	28.3		
	Pringles can (200g)	25.9	25	28.9	26.6		
	Freia milk chocolate plate (200g)	34.9	34.9	40.9	36.9		
Necessities	Gourmetloff bread (520g)	37.9	35	32.5	35.13333333		
	Tine Helmelk (3.5% fat 1L)	19.4	19.4	20.5	19.76666667		
	Frokost eggs (12pk)	38.4	38.4	42.9	39.9		
	Norvegia sliced cheese (300g)	42.4	42	30.9	38.43333333		
		Prisjakt(kr):					
Luxury goods	Air Force 1s (07')	979					
	Airpods (2nd Gen)	1349					
	Playstation 5 (Sony)	5999					
	Tommy Hilfiger watch (gold plated)	1726					

Prices gathered for selected goods

Appendix 1.2

Photos taken by me of stores to present physical evidence that I attended these stores for their prices

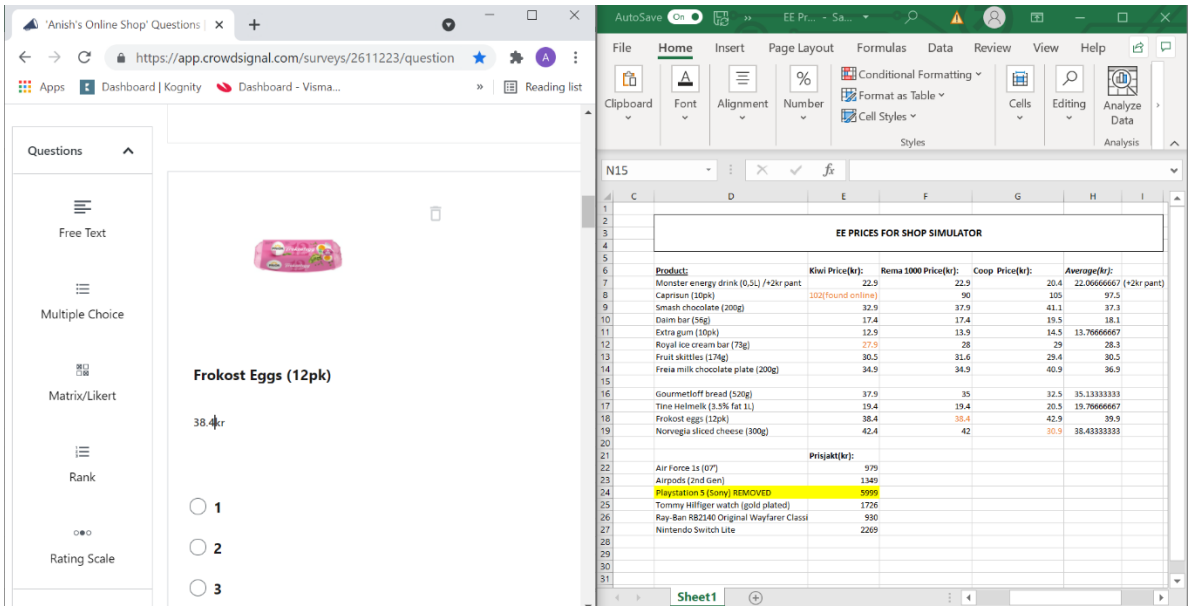
Appendix 2.1



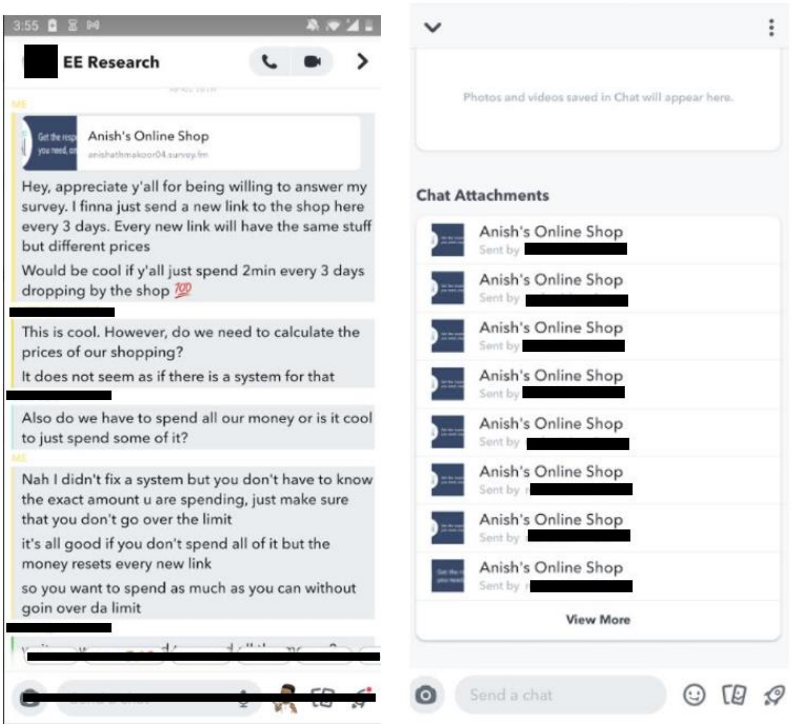
Mobile preview of store simulation

Appendix 2.2

Photo evidence of simulation creation

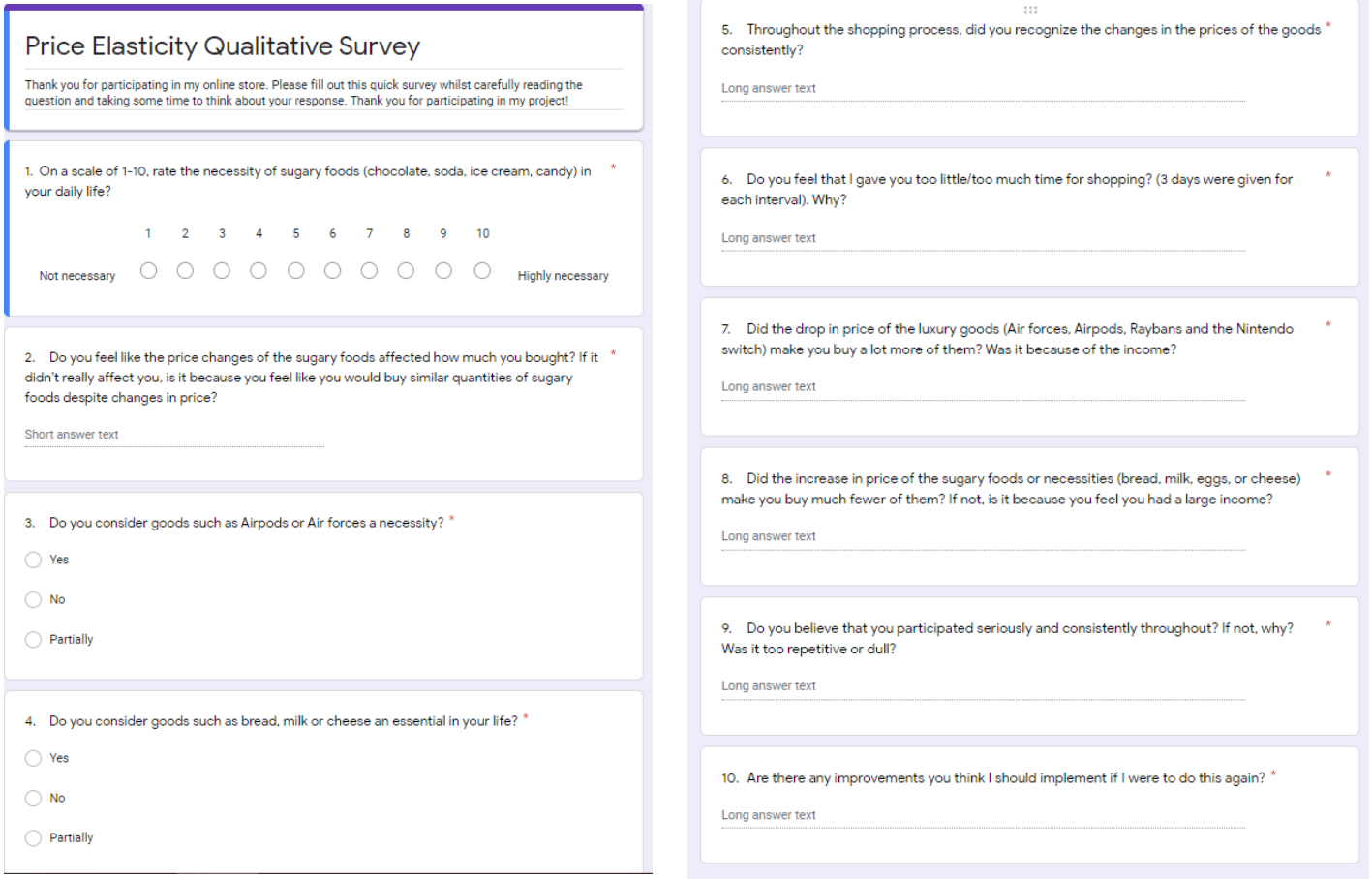


Appendix 2.3



Photos of social media group used to send link attachments to the online simulation every three days and to discuss questions about the shopping process

Appendix 3



Price Elasticity Qualitative Survey

Thank you for participating in my online store. Please fill out this quick survey whilst carefully reading the question and taking some time to think about your response. Thank you for participating in my project!

1. On a scale of 1-10, rate the necessity of sugary foods (chocolate, soda, ice cream, candy) in your daily life? *

1 2 3 4 5 6 7 8 9 10

Not necessary ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ Highly necessary

2. Do you feel like the price changes of the sugary foods affected how much you bought? If it didn't really affect you, is it because you feel like you would buy similar quantities of sugary foods despite changes in price? *

Short answer text

3. Do you consider goods such as Airpods or Air forces a necessity? *

- ○ Yes
- ○ No
- ○ Partially

4. Do you consider goods such as bread, milk or cheese an essential in your life? *

- ○ Yes
- ○ No
- ○ Partially

5. Throughout the shopping process, did you recognize the changes in the prices of the goods consistently? *

Long answer text

6. Do you feel that I gave you too little/too much time for shopping? (3 days were given for each interval). Why? *

Long answer text

7. Did the drop in price of the luxury goods (Air forces, Airpods, Raybans and the Nintendo switch) make you buy a lot more of them? Was it because of the income? *

Long answer text

8. Did the increase in price of the sugary foods or necessities (bread, milk, eggs, or cheese) make you buy much fewer of them? If not, is it because you feel you had a large income? *

Long answer text

9. Do you believe that you participated seriously and consistently throughout? If not, why? Was it too repetitive or dull? *

Long answer text

10. Are there any improvements you think I should implement if I were to do this again? *

Long answer text

Qualitative survey created on google forms

Appendix 4

Figure 2: Quantity demanded of goods sold at my online simulation affected by a change of price

(EXPANDED)

EE Quantity Demanded + Price Data

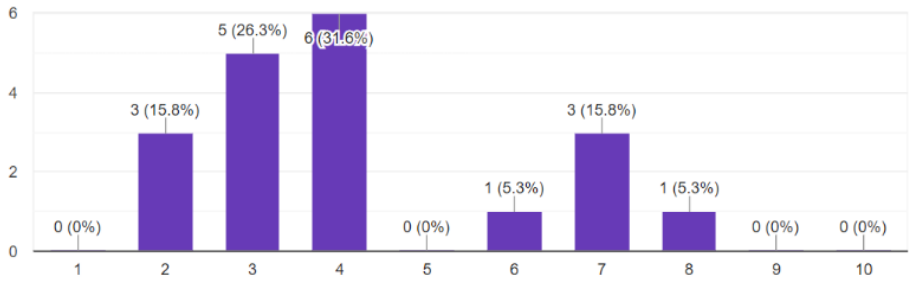
	19/4 - 22/4		22/4 - 26/4		26/4 -29/4		29/4 - 3/5		3/5 - 6/5		6/5 -10/5		10/5 -13/5		13/5 - 17/5		17/5 - 20/5		20/5 -24/5		24/5 - 29/5	
	Price:	Qd:	Price:	Qd:	Price:	Qd:	Price:	Qd:	Price:	Qd:	Price:	Qd:	Price:	Qd:	Price:	Qd:	Price:	Qd:	Price:	Qd:	Price:	Qd:
Monster energy drink (0.5L) /+2kr pant	22.06(+2)								22.06(+2)													
	97.5	19	25.37(+2)						97.5	30(+15)	22.06(+2)											
Caprisun (10pk)		25	112.13	20	28.68(+2)	17	31.99(+2)	8	97.5	45	97.5	19(+10)	82.88	25	15.44(+2)	27	12.13(+2)	37	22.06(+2)	49	97.5	20
	37.3	36	42.9	24	126.75	17	141.38	10	37.3	23	37.3	12	31.71	22	68.25	30 (+30)	53.63	38(+30)	97.5	20	37.3	13
Smash chocolate (200g)			20.82	18	48.49	19	54.09	17							26.11	29(+15)	20.52	50	37.3	20	37.3	
	18.1	26			23.53	15	26.25	13(+10)	18.1	20(+10)	18.1	7	15.39	29(+15)	12.67	31(+30)	9.96	39	18.1	26(+15)	18.1	20
Daim bar (56g)																						
	13.77	22	15.84	16	17.9	10(+15)	19.97	7	13.77	36(+15)	13.77	23(+10)	11.7	26	9.64	33(+45)	7.57	45(+30)	13.77	24(+15)	13.77	18
Extra gum (10pk)																						
	28.3	14	32.55	12(+10)	36.79	9	41.04	8	28.3	30	28.3	8	24.1	15	19.81	17(+30)	15.57	20	28.3	10	28.3	9
Royal ice cream bar (73g)																						
	30.5	32	35.08	26	39.65	22(+15)	44.23	15	30.5	29(+15)	30.5	15(+15)	25.93	23	21.35	19(+15)	16.78	37(+15)	30.5	17(+15)	30.5	20(+15)
Fruit skittles (174g)																						
	36.9	22	42.44	11	47.97	8(+20)	53.51	6	36.9	31	36.9	9	31.37	24	25.83	29 (+15)	20.3	36	36.9	19	36.9	9
Freia milk chocolate plate (200g)																						
	35.13	36 (+30)	35.13	44	35.13	33(+15)	35.13	42	35.13	45	35.13	53(+14)	35.13	52	35.13	53	35.13	44(+15)	45.67	30	24.59	45
Gourmetloff bread (520g)																						
	19.97	43	19.97	42	19.97	39	19.97	49	19.97	37	19.97	34	19.97	32	19.97	30	19.97	40	25.88	33	13.98	50(+15)
Tine Helmelk (3.5% fat 1L)																						
	39.9	25	39.9	20	39.9	19	39.9	16	39.9	26	39.9	18	39.9	19	39.9	15	39.9	22	51.87	21	27.93	28
Frokost eggs (12pk)																						
	38.4	25	38.4	17	38.4	15	38.4	18	38.4	34	38.4	10	38.4	18	38.4	15	38.4 21(+15)		49.92	18	26.88	23
Norvegia sliced cheese (300g)																						
	979	9	979	10	979	4	979	9	1272.7	3	685.3	12	979	6	979	3	979	4	979	6	979	5
Air Force 1s (07')																						
	1349	8	1349	1	1349	5	1349	5	1753.7	2	944.3	10	1349	2	1349	3	1349	2	1349	1	1349	1
Airpods (2nd Gen)																						
	2269	3	2269	3	2269	0	2269	2	2949.7	0	1588.3	8	2269	1	2269	2	2269	2	2269	2	2269	5
Nintendo Switch (Lite)																						
	1726	1	1726	1	1726	4	1726	3	2243.8	2	1208.2	2	1726	2	1726	1	1726	1	1726	1	1726	2
Tommy Hilfiger watch (gold plated)																						
	930	6	930	6	930	4	930	6	1209	4	651	7	930	6	930	5	930	4	930	6	930	7
Ray-Ban RB2140 Original Wayfarer Classi																						
	NORMAL		15% increase		30% increase		45% increase		30% increase		30% decrease		15% decrease		30% decrease		45% decrease		30% increase		30% decrease	
	base data		Sugary foods		Sugary foods		Sugary foods		Luxury goods		Luxury goods		Sugary foods		Sugary foods		Sugary foods		Neccessities		Neccessities	
	28 consumers		26 consumers		27 consumers		25 consumers		26 consumers		25 consumers		23 consumers		22 consumers		22 consumers		23 consumers		22 consumers	

Appendix 5

Results from the qualitative survey presented in Appendix 3

1. On a scale of 1-10, rate the necessity of sugary foods (chocolate, soda, ice cream, candy) in your daily life?

19 responses



2. Do you feel like the price changes of the sugary foods affected how much you bought? If it didn't really affect you, is it because you feel like you would buy similar quantities of sugary foods despite changes in price?

19 responses

I purchased more because it was an opportunity to get more for less

Yes, it affected it.

Yes, because as sugary foods is usually unhealthy, I don't buy a lot but if it's cheaper I might as well buy more.

i did not notice the price change

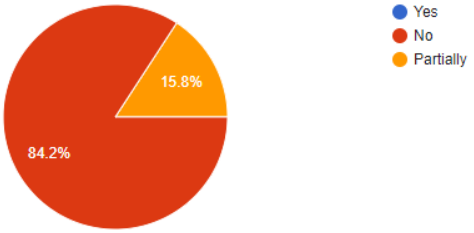
Yeah

yeah i buy less if it's expensive

Price changes did affect how much I bought, as lower prices convinced me to buy 2 or 3 times as many goods as before.

3. Do you consider goods such as Airpods or Air forces a necessity?

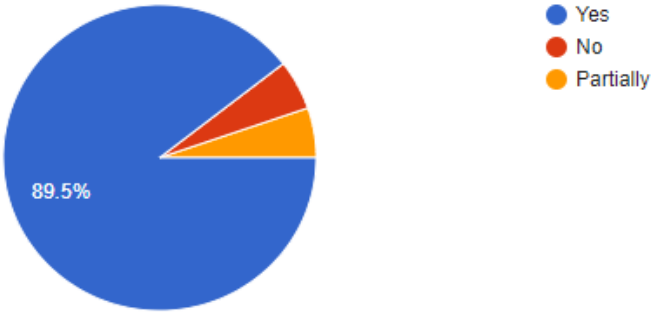
19 responses



There are further answers in the dropdown

4. Do you consider goods such as bread, milk or cheese an essential in your life?

19 responses



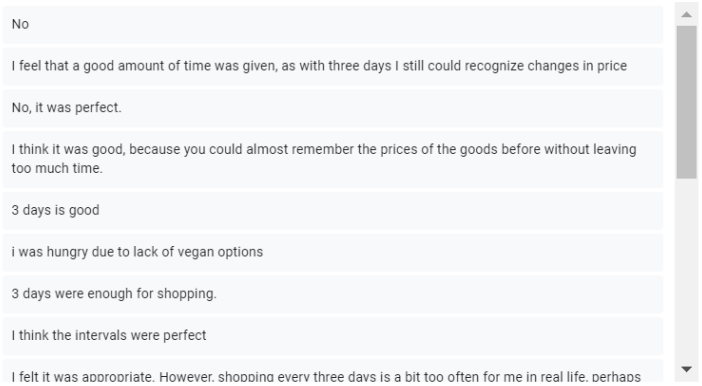
5. Throughout the shopping process, did you recognize the changes in the prices of the goods consistently?

19 responses

There are further answers in the dropdown

6. Do you feel that I gave you too little/too much time for shopping? (3 days were given for each interval). Why?

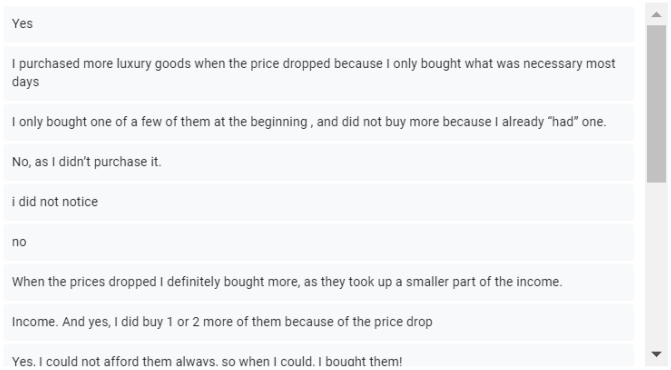
19 responses



There are further answers in the dropdown

7. Did the drop in price of the luxury goods (Air forces, Airpods, Raybans and the Nintendo switch) make you buy a lot more of them? Was it because of the income?

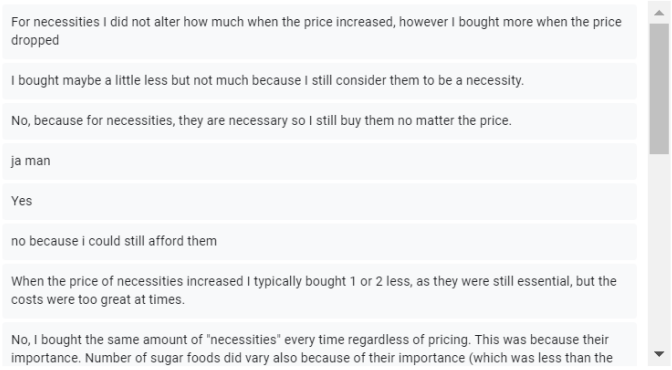
19 responses



There are further answers in the dropdown

8. Did the increase in price of the sugary foods or necessities (bread, milk, eggs, or cheese) make you buy much fewer of them? If not, is it because you feel you had a large income?

19 responses



There are further answers in the dropdown

9. Do you believe that you participated seriously and consistently throughout? If not, why? Was it too repetitive or dull?

19 responses

Yes

I believe I did participate seriously and consistently

Yes, I participated seriously and consistently

ya

yes but it was a bit repetitive

I tried to participate realistically, but it was difficult when the amount of money I had spent so far could not be easily tracked.

I tried to be consistent, but there wasnt much thought behind the purchase other than importance and price. It was very repetitive looking at the same items every time.

I did participate, but I noticed bying mostly the same items and I did not spend all of my money each time.

There are further answers in the dropdown

10. Are there any improvements you think I should implement if I were to do this again?

19 responses

No

Perhaps show the change in price

If there was a way to track the way each person's habits change, like if you had to put in your name at the beginning, so you can see how each person actually changes what they buy depending on the price

vegan options maria went hungry

more variation in products

Add a way to see how much we've spent/have left.

I think you should make a fake website, and add/remove sales on certain items. (Answered by sai btw, I could explain more in person if necessary)

Having a clearer aim as to what you were researching. I was a bit confused as to how I was supposed to buy stuff (for me only? Like my weekly or mid-weekly shopping ect).

There are further answers in the dropdown