Li_Final_Project

May 16, 2019

1 Introduction:

15

16

Apr

The purpose of this project is to investigate how the entry of Chobani in 2007 influenced the sales of Yoplait yoghurt. We have national-level weekly data on (1) total unit sales of Yoplait products, (2) average unit price of Yoplait products, (3) average unit price of Dannon products, which is a substitute for Yoplait yoghurt, and (4) average unit price of Chobani products between 2001 and 2011.

Our analysis includes plotting the data to observe patterns. We also estimate a linear demand curve for Yoplait. Finally, we compute weekly price elasticities of Yoplait demand (own- and two cross-price elasticities) to draw inference about competitive structure, particularly whether the price elasticities changed as a result of Chobani's entry.

```
In [1]: import pandas as pd
         import numpy as np
        %matplotlib inline
         import statsmodels.formula.api as smf
         import matplotlib.pyplot as plt
        df=pd.read_excel('yogurt1.xls')
Out [1]:
                           YOPLAIT UNITS
                                            YOPLAIT PRICE DANNON PRICE
                                                                            CHOBANI PRICE
              WEEK MONTH
         0
                 1
                      Jan
                                  1431790
                                                       0.76
                                                                      1.04
                                                                                       0.00
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                                  1549503
         2
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                                  1448646
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                                                       0.82
                      Jan
                                  1398011
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                                                                      1.10
                                                                                       0.00
                                  1525899
         5
                 6
                                                                                       0.00
                      Feb
                                  1315745
                                                       0.87
                                                                      0.89
         6
                 7
                                                       0.87
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                                                                                       0.00
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                                  1247943
         7
                 8
                      Feb
                                  1206063
                                                       0.89
                                                                      1.06
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        8
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                      Mar
                                  1541804
                                                                      1.11
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                                  1493644
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                                  1355595
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                                  1498930
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                      Apr
         14
                15
                      Apr
                                  1321056
                                                       0.89
                                                                      1.10
                                                                                       0.00
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0.87

0.97

0.00

1203680

16	17	Apr	1236598	0.94	0.94	0.00
17	18	May	1493550	0.88	1.11	0.00
18	19	May	1262692	0.95	1.02	0.00
19	20	May	1365748	0.87	0.93	0.00
20	21	May	1283943	0.92	1.08	0.00
21	22	May	1373136	0.86	1.03	0.00
22	23	Jun	1550108	0.84	0.94	0.00
23	24	Jun	1411876	0.84	1.06	0.00
24	25	Jun	1277361	0.87	0.99	0.00
25	26	Jun	1158561	0.91	1.05	0.00
26	27	Jul	1259457	0.88	1.09	0.00
27	28	Jul	1175128	0.92	0.96	0.00
28	29	Jul	1310654	0.87	1.04	0.00
29	30	Jul	1264448	0.88	1.10	0.00
543	544	Jun	1903941	0.85	1.56	1.40
544	545	Jun	1654621	0.97	1.54	1.39
545	546	Jun	1737019	0.93	1.42	1.40
546	547	Jun	1759658	0.91	1.66	1.40
547	548	Jun	1746264	0.91	1.63	1.41
548	549	Jul	1615631	0.99	1.54	1.41
549	550	Jul	1851221	0.93	1.60	1.40
550	551	Jul	1898320	0.89	1.61	1.41
551	552	Jul	1509453	0.99	1.50	1.39
552	553	Aug	1879026	0.95	1.65	1.28
553	554	Aug	2025709	0.97	1.58	1.37
554	555	Aug	1867477	0.95	1.65	1.38
555	556	Aug	1594002	1.03	1.65	1.23
556	557	Sep	1613750	1.02	1.63	1.37
557	558	Sep	2032965	0.95	1.61	1.33
558	559	Sep	1745274	1.06	1.64	1.41
559	560	Sep	1679836	1.03	1.67	1.36
560	561	Sep	1792941	0.99	1.71	1.36
561	562	Oct	1890071	0.97	1.64	1.29
562	563	Oct	1854960	0.99	1.73	1.24
563	564	Oct	1681291	1.00	1.68	1.32
564	565	Oct	1570368	0.99	1.78	1.31
565	566	Nov	1570216	1.00	1.76	1.21
566	567	Nov	1737014	0.97	1.86	1.30
567	568	Nov	1428985	1.06	1.75	1.31
568	569	Nov	1076198	1.10	1.77	1.38
569	570	Dec	1523707	1.00	1.83	1.31
570	571	Dec	1579472	1.00	1.88	1.28
571	572	Dec	1223610	1.07	1.85	1.25
572	573	Dec	1092610	1.04	1.90	1.40

LN(WEEK) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov 0 0.000000 1 0 0 0 0 0 0 0 0 0

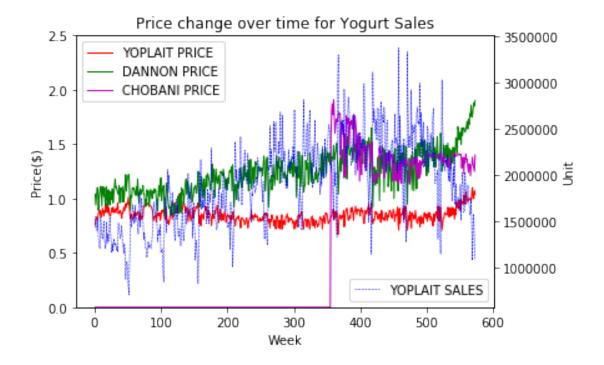
1	0.693147	1	0	0	0	0	0	0	0	0	0	0
2	1.098612	1	0	0	0	0	0	0	0	0	0	0
3	1.386294	1	0	0	0	0	0	0	0	0	0	0
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4	1.609438	0	1	0	0	0	0	0	0	0	0	0
5	1.791759	0	1	0	0	0	0	0	0	0	0	0
6	1.945910	0	1	0	0	0	0	0	0	0	0	0
7	2.079442	0	1	0	0	0	0	0	0	0	0	0
8	2.197225	0	0	1	0	0	0	0	0	0	0	0
9	2.302585	0	0	1	0	0	0	0	0	0	0	0
10	2.397895	0	0	1	0	0	0	0	0	0	0	0
11	2.484907	0	0	1	0	0	0	0	0	0	0	0
12	2.564949	0	0	1	0	0	0	0	0	0	0	0
13	2.639057	0	0	0	1	0	0	0	0	0	0	0
14	2.708050	0	0	0	1	0	0	0	0	0	0	0
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15	2.772589	0	0	0	1	0	0	0	0	0	0	0
16	2.833213	0	0	0	1	0	0	0	0	0	0	0
17	2.890372	0	0	0	0	1	0	0	0	0	0	0
18	2.944439	0	0	0	0	1	0	0	0	0	0	0
19	2.995732	0	0	0	0	1	0	0	0	0	0	0
20	3.044522	0	0	0	0	1	0	0	0	0	0	0
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21	3.091042	0	0	0	0	1	0	0	0	0	0	0
22	3.135494	0	0	0	0	0	1	0	0	0	0	0
23	3.178054	0	0	0	0	0	1	0	0	0	0	0
24	3.218876	0	0	0	0	0	1	0	0	0	0	0
25	3.258097	0	0	0	0	0	1	0	0	0	0	0
26	3.295837	0	0	0	0	0	0	1	0	0	0	0
27	3.332205	0	0	0	0	0	0	1	0	0	0	0
		_			-			_			-	
28	3.367296	0	0	0	0	0	0	1	0	0	0	0
29	3.401197	0	0	0	0	0	0	1	0	0	0	0
543	6.298949	0	0	0	0	0	1	0	0	0	0	0
544	6.300786	0	0	0	0	0	1	0	0	0	0	0
545	6.302619	0	0	0	0	0	1	0	0	0	0	0
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546	6.304449	0	0	0	0	0	1	0	0	0	0	0
547	6.306275	0	0	0	0	0	1	0	0	0	0	0
548	6.308098	0	0	0	0	0	0	1	0	0	0	0
549	6.309918	0	0	0	0	0	0	1	0	0	0	0
550	6.311735	0	0	0	0	0	0	1	0	0	0	0
551	6.313548	0	0	0	0	0	0	1	0	0	0	0
552	6.315358	0	0	0	0	0	0	0	1	0	0	0
553	6.317165	0	0	0	0	0	0	0	1	0	0	0
554	6.318968	0	0	0	0	0	0	0	1	0	0	0
555	6.320768	0	0	0	0	0	0	0	1	0	0	0
556	6.322565	0	0	0	0	0	0	0	0	1	0	0
557	6.324359	0	0	0	0	0	0	0	0	1	0	0
558	6.326149	0	0	0	0	0	0	0	0	1	0	0
559	6.327937	0	0	0	0	0	0	0	0	1	0	0
560	6.329721	0	0	0	0	0	0	0	0	1	0	0

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561 6.331502
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565 6.338594
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```

[573 rows x 18 columns]

1.0.1 Graphical Analysis

```
In [2]: df1=df.iloc[:,[0,2,3,4,5,]]
        df1
        A1=df1.iloc[:,[0,1]]
        A2=df1.iloc[:,[0,2]]
        A3=df1.iloc[:,[0,3]]
        A4=df1.iloc[:,[0,4]]
In [3]: #fiq, ax =plt.subplots()
       plt.plot(A2["WEEK"],A2["YOPLAIT PRICE"],color="r",linewidth = 1)
       plt.plot(A3["WEEK"],A3["DANNON PRICE"],color="g",linewidth = 1)
       plt.plot(A4["WEEK"],A4["CHOBANI PRICE"],color="m",linewidth = 1)
       plt.ylim(0,2.50)
       plt.title("Price change over time for Yogurt Sales")
       plt.ylabel("Price($)")
       plt.xlabel("Week")
       plt.legend(["YOPLAIT PRICE","DANNON PRICE","CHOBANI PRICE"])
       plt2=plt.twinx()
       plt2.plot(A1["WEEK"],A1["YOPLAIT UNITS"],color="b",linewidth = 0.5,linestyle="--")
       plt2.set_ylabel("Unit")
       plt2.legend(["YOPLAIT SALES"],loc=4)
       plt.figure(figsize=(20,10))
Out[3]: <Figure size 1440x720 with 0 Axes>
```



<Figure size 1440x720 with 0 Axes>

Observations from above graph:

- 1. Yoplait sales increase until around week 400 and then fluctuate over time. After week 500, Yoplait sales starts to decrease.
- 2. Yoplait sales exhibit seasonality.
- 3. When Chobani enters the market at around week 350, it set the price higher than Yoplait's and Dannon's price. But the price then decrease immediately to around 1.2 dollars and was maintained at a similar level with fluctuation.
- 4. Yoplait's price is relatively stable until around week 500. Then its price starts to increase.
- 5. In contrast, Dannon's price increased to around week 400. Then its price decreased when Chobani cut off the price, and increased again more sharply after around week 500.

These observation could be interpreted as follows:

• 1. The decrease of Yoplait sales after week 500 might be affected by the increase of its sales price.

- 2. The decrease of Yoplait sales could also related to the Chobani's price decrease. When Chobani entered the market, its sales price was set too high above others to compete with Yoplait and Dannon due to the customers' brand loyalty. Then the price was cutted off strategically around week 400 to attract customers that used to purchase products of Yoplait. This could be verified that at that time, Yoplait sales also started to decrease.
- 3. The sharp increase of Dannon's price is the reaction to the increase of Yoplait's price after week 500.

```
In [4]: df=df.rename(columns={df.columns[2]: "YOPLAIT_UNITS", df.columns[3]: "YOPLAIT_PRICE",
                                   df.columns[4]: "DANNON_PRICE", df.columns[5]: "CHOBANI_PRICE", df.
         df
Out [4]:
                             YOPLAIT_UNITS
                                                                DANNON_PRICE
               WEEK MONTH
                                              YOPLAIT_PRICE
                                                                                CHOBANI_PRICE
         0
                  1
                                    1431790
                                                         0.76
                                                                         1.04
                                                                                           0.00
                       Jan
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         2
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                                                         0.83
                                                                         1.02
                                                                                           0.00
                       Jan
                                    1448646
         3
                  4
                                                         0.82
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                       Jan
                                    1398011
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                                    1247943
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                       Apr
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                                    1262692
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                 22
         21
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                       May
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                       Jun
                                    1550108
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547	548	Jui	1	1	74626	4		0.9	1		1.63			1.41
548	549	Ju:	L	1	61563	1		0.9	9		1.54			1.41
549	550	Ju.	L	1	85122	1		0.9	3		1.60			1.40
550	551	Ju	L	1	89832	0		0.8	9		1.61			1.41
551	552	Ju:	L	1	50945	3		0.9	9		1.50			1.39
552	553	Aug			87902			0.9	5		1.65			1.28
553	554	Aug	-		02570			0.9			1.58			1.37
554	555	Aug			86747			0.9			1.65			1.38
555	556	Aug			59400			1.0			1.65			1.23
556	557	Sej			61375			1.0			1.63			1.37
557	558	Sej						0.9			1.61		1.33	
558	559			2032965 1745274							1.64			1.41
		Sep		1679836			1.06 1.03							
559	560	Sep		1679836 1792941							1.67			1.36
560	561	Sej						0.9			1.71			1.36
561	562	0c1			89007			0.9			1.64			1.29
562	563	0c1			85496			0.9			1.73			1.24
563	564	0c1			68129			1.0			1.68			1.32
564	565	0ct		1570368 1570216				0.9			1.78			1.31
565	566	roN		1570216 1737014				1.0			1.76			1.21
566	567	Nov						0.9			1.86			1.30
567	568	Nov		1428985				1.0			1.75			1.31 1.38
568	569	roN	J	1076198				1.1	0		1.77			
569	570	De	2	1	52370	7		1.0	0		1.83			1.31
570	571	Dec	2	1	57947	2		1.0	0		1.88			1.28
571	572	Dec	2	1	22361	0		1.0	7		1.85			1.25
572	F70													
	573	De	2	1	09261	0		1.0	4		1.90			1.40
	5/3	De	C	1	09261	0		1.0	4		1.90			1.40
	LNWE		Jan	1 Feb	09261 Mar	0 Apr	May	1.0 Jun	4 Jul	Aug	1.90 Sep	Oct	Nov	1.40
0		EEK					May O			Aug 0			Nov O	1.40
	LNWE	EEK DOO	Jan	Feb	Mar	Apr	•	Jun	Jul		Sep	Oct		1.40
0	LNWE	EEK 000 147	Jan 1	Feb 0	Mar O	Apr 0	0	Jun 0	Jul 0	0	Sep 0	Oct O	0	1.40
0 1	LNWE 0.0000 0.6931	EEK 000 147 512	Jan 1 1	Feb 0 0	Mar 0 0	Apr 0 0	0	Jun 0 0	Jul 0 0	0	Sep 0 0	Oct 0 0	0	1.40
0 1 2 3	LNWE 0.0000 0.6931 1.0986	EEK 000 147 612 294	Jan 1 1 1	Feb 0 0	Mar 0 0	Apr 0 0	0 0	Jun 0 0	Jul 0 0	0 0	Sep 0 0	Oct 0 0	0 0 0	1.40
0 1 2 3 4	LNWE 0.0000 0.6931 1.0986 1.3862	EEK 000 147 512 294 138	Jan 1 1 1 1 0	Feb 0 0 0 0	Mar 0 0 0 0	Apr 0 0 0 0	0 0 0 0	Jun 0 0 0 0	Jul 0 0 0 0	0 0 0 0	Sep 0 0 0 0	Oct 0 0 0 0	0 0 0 0	1.40
0 1 2 3 4 5	LNWE 0.0000 0.6931 1.0986 1.3862 1.6094	EEK 000 147 312 294 438 759	Jan 1 1 1 1 0 0	Feb 0 0 0 0 1 1 1	Mar 0 0 0 0 0	Apr 0 0 0 0 0	0 0 0 0 0	Jun 0 0 0 0 0	Jul 0 0 0 0 0 0 0 0 0	0 0 0 0 0	Sep 0 0 0 0 0	Oct 0 0 0 0 0 0 0	0 0 0 0 0	1.40
0 1 2 3 4 5 6	LNWE 0.0000 0.6931 1.0986 1.3862 1.6094 1.7917	EEK 000 147 512 294 138 759	Jan 1 1 1 1 0 0	Feb 0 0 0 0 1 1 1 1	Mar 0 0 0 0 0	Apr 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0	Jun 0 0 0 0 0 0	Jul 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0	Sep 0 0 0 0 0	Oct 0 0 0 0 0 0 0 0	0 0 0 0 0	1.40
0 1 2 3 4 5 6 7	LNWE 0.0000 0.6931 1.0986 1.3862 1.6094 1.7917 1.9458	EEK 000 147 512 294 138 759 910	Jan 1 1 1 0 0 0 0	Feb 0 0 0 0 1 1 1 1 1 1 1	Mar 0 0 0 0 0 0	Apr 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0	Jun 0 0 0 0 0 0 0 0 0	Jul 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0	Sep 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Oct 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0	1.40
0 1 2 3 4 5 6 7 8	LNWE 0.0000 0.6931 1.0986 1.3862 1.6094 1.7917 1.9459 2.0794	EEK 000 147 312 294 438 759 910 142 225	Jan 1 1 1 0 0 0 0 0	Feb 0 0 0 0 1 1 1 1 0 0	Mar 0 0 0 0 0 0 0	Apr 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0	Jun 0 0 0 0 0 0 0 0 0 0 0	Jul 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0	Sep 0 0 0 0 0 0 0	Oct 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0	1.40
0 1 2 3 4 5 6 7 8	LNWF 0.0000 0.6931 1.0986 1.3862 1.6094 1.7917 1.9458 2.0794 2.1972 2.3028	EEK 000 147 512 294 138 759 910 142 225 585	Jan 1 1 1 0 0 0 0 0 0	Feb 0 0 0 0 1 1 1 1 0 0 0	Mar 0 0 0 0 0 0 0 0	Apr 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0	Jun 0 0 0 0 0 0 0 0 0 0 0 0	Jul 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0	Sep 0 0 0 0 0 0 0 0	Oct 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0	1.40
0 1 2 3 4 5 6 7 8 9 10	LNWE 0.0000 0.6931 1.0986 1.3862 1.6094 1.7917 1.9458 2.0794 2.1972 2.3028	EEK 000 147 612 294 138 759 910 142 225 585 395	Jan 1 1 1 0 0 0 0 0 0 0 0	Feb 0 0 0 0 1 1 1 1 0 0 0 0 0	Mar 0 0 0 0 0 0 0 0 1 1	Apr 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Jun 0 0 0 0 0 0 0 0 0 0 0 0 0	Jul 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0	Sep 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Oct 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0	1.40
0 1 2 3 4 5 6 7 8 9 10 11	LNWE 0.0000 0.6931 1.0986 1.3862 1.6094 1.7917 1.9459 2.0794 2.1972 2.3028 2.3978 2.4849	EEK 000 147 612 294 138 759 910 142 225 585 395 907	Jan 1 1 1 0 0 0 0 0 0 0 0	Feb 0 0 0 0 1 1 1 1 0 0 0 0 0 0 0	Mar 0 0 0 0 0 0 0 1 1 1	Apr 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		Jun 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Jul 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0	Sep 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Oct 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0	1.40
0 1 2 3 4 5 6 7 8 9 10 11 12	LNWF 0.0000 0.6931 1.0986 1.3862 1.6094 1.7917 1.9458 2.0794 2.1972 2.3028 2.3978 2.4848	EEK 000 147 312 294 138 759 910 142 225 585 395 907 949	Jan 1 1 1 0 0 0 0 0 0 0 0 0 0	Feb 0 0 0 1 1 1 0 0 0 0	Mar 0 0 0 0 0 0 0 0 1 1 1 1	Apr 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		Jun 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Jul 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0	Sep 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Oct 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0	1.40
0 1 2 3 4 5 6 7 8 9 10 11 12 13	LNWE 0.0000 0.6931 1.0986 1.3862 1.6094 1.7917 1.9459 2.0794 2.1972 2.3025 2.3978 2.4849 2.5649	EEK 000 147 512 294 138 759 910 142 225 585 395 907 949 057	Jan 1 1 1 0 0 0 0 0 0 0 0 0 0 0	Feb 0 0 0 0 1 1 1 1 0 0 0 0 0 0 0 0 0 0	Mar 0 0 0 0 0 0 0 1 1 1 1	Apr 0 0 0 0 0 0 0 0 0 0 0 1		Jun 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Jul 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0	Sep 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Oct 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0	1.40
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14	LNWE 0.0000 0.6931 1.0986 1.3862 1.6094 1.7917 1.9459 2.0794 2.1972 2.3025 2.3978 2.4849 2.5649 2.7080	EEK 000 147 612 294 138 759 910 142 225 585 907 949 057 050	Jan 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0	Feb 0 0 0 0 1 1 1 1 0 0 0 0 0 0 0 0 0 0 0	Mar 0 0 0 0 0 0 0 1 1 1 1 0 0	Apr 0 0 0 0 0 0 0 0 0 0 1 1		Jun 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Jul 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		Sep 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Oct 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0	1.40
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15	LNWF 0.0000 0.6931 1.0986 1.3862 1.6094 1.7917 1.9459 2.0794 2.1972 2.3025 2.3978 2.4849 2.5649 2.7080 2.7725	EEK 000 147 512 294 138 759 910 142 225 585 395 907 949 057 050 589	Jan 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Feb 0 0 0 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0	Mar 0 0 0 0 0 0 0 1 1 1 1 0 0	Apr 0 0 0 0 0 0 0 0 0 0 1 1 1 1		Jun 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Jul 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		Sep 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Oct 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		1.40
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16	LNWF 0.0000 0.6931 1.0986 1.3862 1.6094 1.7917 1.9458 2.0794 2.1972 2.3028 2.3978 2.4849 2.5649 2.7728 2.8332	EEK 000 147 512 294 138 759 910 142 225 585 907 949 057 050 589 213	Jan 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Feb 0 0 0 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0	Mar 0 0 0 0 0 0 0 1 1 1 1 0 0 0	Apr 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1		Jun 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Jul 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		Sep 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Oct 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		1.40
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17	LNWE 0.0000 0.6931 1.0986 1.3862 1.6094 1.7917 1.9459 2.0794 2.1972 2.3025 2.3978 2.4849 2.5649 2.7080 2.7725 2.8332 2.8903	EEK 000 147 512 294 138 759 910 142 225 585 907 949 057 050 589 213 372	Jan 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Feb 0 0 0 0 1 1 1 1 0 0 0 0 0 0 0 0 0 0 0	Mar 0 0 0 0 0 0 0 1 1 1 1 0 0 0 0	Apr 0 0 0 0 0 0 0 0 0 0 1 1 1 0 0		Jun 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Jul 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		Sep 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Oct 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		1.40
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16	LNWF 0.0000 0.6931 1.0986 1.3862 1.6094 1.7917 1.9458 2.0794 2.1972 2.3028 2.3978 2.4849 2.5649 2.7728 2.8332	EEK 000 147 512 294 138 759 910 142 225 585 395 907 949 957 950 950 950 950 950 950 950 950	Jan 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Feb 0 0 0 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0	Mar 0 0 0 0 0 0 0 1 1 1 1 0 0 0	Apr 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1		Jun 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Jul 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		Sep 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Oct 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		1.40

20	3.044522	0	0	0	0	1	0	0	0	0	0	0
21	3.091042	0	0	0	0	1	0	0	0	0	0	0
22	3.135494	0	0	0	0	0	1	0	0	0	0	0
23	3.178054	0	0	0	0	0	1	0	0	0	0	0
24	3.218876	0	0	0	0	0	1	0	0	0	0	0
25	3.258097	0	0	0	0	0	1	0	0	0	0	0
26	3.295837	0	0	0	0	0	0	1	0	0	0	0
27	3.332205	0	0	0	0	0	0	1	0	0	0	0
28	3.367296	0	0	0	0	0	0	1	0	0	0	0
29	3.401197	0	0	0	0	0	0	1	0	0	0	0
543	6.298949	0	0	0	0	0	1	0	0	0	0	0
544	6.300786	0	0	0	0	0	1	0	0	0	0	0
545	6.302619	0	0	0	0	0	1	0	0	0	0	0
546	6.304449	0	0	0	0	0	1	0	0	0	0	0
547	6.306275	0	0	0	0	0	1	0	0	0	0	0
548	6.308098	0	0	0	0	0	0	1	0	0	0	0
549	6.309918	0	0	0	0	0	0	1	0	0	0	0
550	6.311735	0	0	0	0	0	0	1	0	0	0	0
551	6.313548	0	0	0	0	0	0	1	0	0	0	0
552	6.315358	0	0	0	0	0	0	0	1	0	0	0
553	6.317165	0	0	0	0	0	0	0	1	0	0	0
554	6.318968	0	0	0	0	0	0	0	1	0	0	0
555	6.320768	0	0	0	0	0	0	0	1	0	0	0
556	6.322565	0	0	0	0	0	0	0	0	1	0	0
557	6.324359	0	0	0	0	0	0	0	0	1	0	0
558	6.326149	0	0	0	0	0	0	0	0	1	0	0
559	6.327937	0	0	0	0	0	0	0	0	1	0	0
560	6.329721	0	0	0	0	0	0	0	0	1	0	0
561	6.331502	0	0	0	0	0	0	0	0	0	1	0
562	6.333280	0	0	0	0	0	0	0	0	0	1	0
563	6.335054	0	0	0	0	0	0	0	0	0	1 1	0
564	6.336826	0	-	0	0	_	0	0	_	0	_	0
565	6.338594	0	0	0	0	0	0	0	0	0	0	1
566	6.340359	0	0	0	0	0	0	0	0	0	0	1
567 569	6.342121 6.343880	0	0	0	0	0	0	0	0	0	0	1 1
568		0	0	0	0	0	0	0		0	0	
569 570	6.345636 6.347389	0	0	0	0	0	0	0	0	0	0	0
	6.349139	0	0 0	0	0		0	0	0	0	0	0
571 572	6.350886		0			0	0	0	0		0	0
572	0.330886	0	U	0	0	0	U	0	U	0	0	0

[573 rows x 18 columns]

1.0.2 Demand Curve Estimation

We conduct regression analysis using the entire data and estimate a linear demand for Yoplait products. We include the following three set of variables as Independent Variables:

(1) three prices

- (2) time trend (natural log of the variable WEEK, i.e., ln(WEEK))
- (3) monthly dummies

Inclusion of three prices allows us to investigate own- and cross-price elasticities. Time trend and monthly dummies are important for capturing the variation in sales not due to price changes.

In [5]: reg_all=smf.ols("YOPLAIT_UNITS~YOPLAIT_PRICE+DANNON_PRICE+CHOBANI_PRICE+LNWEEK+Jan+Febprint(reg_all.summary())

OLS R	legres	sion	Results
-------	--------	------	---------

org regression results												
Dep. Variable:	Y	OPLAIT_UNITS	R-square	d:		0.876						
Model:		OLS	Adj. R-s			0.873						
Method:	L	east Squares	F-statis	tic:		262.0						
Date:	Tue,	14 May 2019	Prob (F-	statistic):	8.50e-241							
Time:		14:02:56	Log-Like	lihood:		-7698.2						
No. Observatio	ns:	573	AIC:		1.543e+04							
Df Residuals:		557	BIC:		1	.550e+04						
Df Model:		15										
Covariance Typ		nonrobust										
=========	coef	std err	t	P> t	[0.025	0.975]						
Intercept	4.126e+06	1.43e+05	28.858	0.000	3.85e+06	4.41e+06						
YOPLAIT_PRICE	-4.307e+06	1.27e+05	-34.036	0.000	-4.56e+06	-4.06e+06						
DANNON_PRICE	8.058e+04	5.42e+04	1.486	0.138	-2.6e+04	1.87e+05						
CHOBANI_PRICE	2.559e+05	1.5e+04	17.008	0.000	2.26e+05 2.85e+0							
LNWEEK	1.573e+05	1.04e+04	15.067	0.000	1.37e+05	1.78e+05						
Jan	4.168e+05	3.75e+04	11.109	0.000	3.43e+05	4.9e+05						
Feb	4.577e+05	3.67e+04	12.487	0.000	3.86e+05	5.3e+05						
Mar	4.763e+05	3.5e+04	13.593	0.000	4.07e+05	5.45e+05						
Apr	4.261e+05	3.53e+04	12.074	0.000	3.57e+05	4.95e+05						
May	4.201e+05	3.51e+04	11.978	0.000	3.51e+05	4.89e+05						
Jun	3.64e+05	3.5e+04	10.397	0.000	2.95e+05	4.33e+05						
Jul	3.434e+05	3.43e+04	10.014	0.000	2.76e+05	4.11e+05						
Aug	4.066e+05	3.44e+04	11.819	0.000	3.39e+05	4.74e+05						
Sep	4.536e+05	3.45e+04	13.150	0.000	3.86e+05	5.21e+05						
Oct	3.495e+05	3.51e+04	9.964	0.000	2.81e+05	4.18e+05						
Nov	1.39e+05	3.45e+04 ======	4.032	0.000	7.13e+04	2.07e+05						
Omnibus:		6.978	Durbin-W			0.939						
Prob(Omnibus):		0.031	Jarque-B	era (JB):	10.093							
Skew:		-0.022	Prob(JB)	0.00643								
Kurtosis:		3.649	Cond. No	•		155.						

Warnings:

[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.

```
In [6]: from sklearn.linear_model import LinearRegression
        y = df.iloc[:,2]
       X = df.iloc[:,3:]
In [7]: reg = LinearRegression().fit(X, y)
        intercept = reg.intercept_
       print('Estimated intercept coefficient:', intercept)
Estimated intercept coefficient: 4126408.170070924
In [8]: vari = X.columns.values.tolist()
        vari.insert(0, 'Intercept')
        Para_Est = pd.DataFrame(list(zip(vari, reg_all.params, reg_all.bse)), columns = ['Vari
        Para_Est
Out[8]:
                Variables Estimated Coefficients Standard Error
                                     4.126408e+06 142989.818025
                Intercept
           YOPLAIT_PRICE
        1
                                    -4.306898e+06 126539.055097
           DANNON_PRICE
        2
                                     8.058438e+04 54246.841616
        3
           CHOBANI_PRICE
                                     2.558855e+05
                                                    15045.131681
                   LNWEEK
        4
                                     1.573041e+05
                                                     10440.104876
        5
                      Jan
                                     4.167889e+05
                                                     37517.068886
        6
                      Feb
                                     4.577361e+05
                                                     36657.886979
        7
                      Mar
                                     4.763211e+05
                                                     35042.897995
        8
                                     4.260627e+05
                                                     35287.490489
                      Apr
        9
                      May
                                     4.200777e+05
                                                     35071.836010
        10
                      Jun
                                     3.639905e+05
                                                     35009.255878
                      Jul
        11
                                     3.433866e+05
                                                     34289.483761
        12
                      Aug
                                     4.065518e+05
                                                     34396.814839
                      Sep
                                     4.535511e+05
        13
                                                     34490.366778
        14
                      Oct
                                     3.494667e+05
                                                     35071.951795
        15
                      Nov
                                     1.390423e+05
                                                     34487.120350
```

Regression Analysis:

• The linear demand is estiamted as the format:

```
Yoplait units sales= b0 + b1 * Yoplait Price + b2 * Dannon Price+ b3 * Chobani Price + b4
```

• With the help of regression calculation tool, the estimated regression function is finally determined as:

```
Yoplait units sales= 4126408 -4306898 * Yoplait Price + 80584.38 * Dannon Price + 255885 + 157304.1 * LnWeek + 416788.9 * Jan + 457736.1 * Feb + 476321.1 * Mar + 426062.7 * Apr + 363990.5 * Jun + 343386.6 * Jul + 406551.8 * Aug + 453551.1 * Sep + 349466.7 * Oct + 13
```

• The results seem to be consistent with theory: The Yoplait price has a negative effect on Yoplait's sales, while the price of Dannon and Chobani has a positive effect on Yoplait's sales. The time also influence the sales positively. All the coefficients except Dannon Price are significant. The adjusted R squared value is pretty high at 87%, indicating high goodness of fit.

```
In [9]: Month = Para_Est.iloc[5:16,0:2]
        Month.columns = ['MONTH','Monthly Dummy Effects']
        Month.loc[-1] = ['Dec', 0]
        Month
Out [9]:
                    Monthly Dummy Effects
             MONTH
         5
               Jan
                             416788.905078
         6
               Feb
                             457736.148745
         7
                             476321.069384
               Mar
         8
                             426062.711488
               Apr
         9
                             420077.724684
               May
         10
               Jun
                             363990.520966
         11
               Jul
                             343386.604344
         12
               Aug
                             406551.827621
         13
                             453551.117530
               Sep
         14
               Oct
                             349466.722548
         15
               Nov
                             139042.340772
        -1
               Dec
                                   0.000000
In [10]: newdf = df.merge(Month,on='MONTH',how='left')
         newdf
         #Add 'Monthly Dummy Effects'
Out[10]:
               WEEK MONTH YOPLAIT_UNITS
                                            YOPLAIT_PRICE
                                                             DANNON_PRICE
                                                                             CHOBANI_PRICE
         0
                  1
                       .Jan
                                   1431790
                                                       0.76
                                                                      1.04
                                                                                      0.00
                  2
         1
                       Jan
                                   1549503
                                                       0.80
                                                                      0.94
                                                                                      0.00
         2
                  3
                       Jan
                                                       0.83
                                                                      1.02
                                                                                      0.00
                                   1448646
         3
                  4
                       Jan
                                   1398011
                                                       0.82
                                                                      1.10
                                                                                      0.00
         4
                  5
                       Feb
                                   1525899
                                                       0.81
                                                                      1.10
                                                                                      0.00
         5
                  6
                       Feb
                                                       0.87
                                                                      0.89
                                                                                      0.00
                                   1315745
                  7
         6
                       Feb
                                   1247943
                                                       0.87
                                                                      1.00
                                                                                      0.00
         7
                  8
                       Feb
                                   1206063
                                                       0.89
                                                                      1.06
                                                                                      0.00
```

1541804

1493644

1355595

1309235

1370437

1498930

0.85

0.83

0.87

0.91

0.87

0.84

1.11

1.11

0.93

1.09

1.11

1.02

0.00

0.00

0.00

0.00

0.00

0.00

8

9

10

11

12

13

9

10

11

12

13

Mar

Mar

Mar

Mar

Mar

Apr

14	15	Apr	1321056	0.89	1.10	0.00
15	16	Apr	1203680	0.87	0.97	0.00
16	17	Apr	1236598	0.94	0.94	0.00
17	18	May	1493550	0.88	1.11	0.00
18	19	May	1262692	0.95	1.02	0.00
		-				
19	20	May	1365748	0.87	0.93	0.00
20	21	May	1283943	0.92	1.08	0.00
21	22	May	1373136	0.86	1.03	0.00
22	23	Jun	1550108	0.84	0.94	0.00
23	24	Jun	1411876	0.84	1.06	0.00
24	25	Jun	1277361	0.87	0.99	0.00
25	26	Jun	1158561	0.91	1.05	0.00
26	27	Jul	1259457	0.88	1.09	0.00
27	28	Jul	1175128	0.92	0.96	0.00
28	29	Jul	1310654	0.87	1.04	0.00
29	30	Jul	1264448	0.88	1.10	0.00
 543	 544	Jun	 1903941	0.85	 1.56	1.40
544	545	Jun	1654621	0.97	1.54	1.39
545	546	Jun	1737019	0.93	1.42	1.40
546	547	Jun	1759658	0.91	1.66	1.40
547	548	Jun	1746264	0.91	1.63	1.41
548	549	Jul	1615631	0.99	1.54	1.41
549	550	Jul	1851221	0.93	1.60	1.40
550	551	Jul	1898320	0.89	1.61	1.41
551	552	Jul	1509453	0.99	1.50	1.39
552	553	Aug	1879026	0.95	1.65	1.28
553	554	Aug	2025709	0.97	1.58	1.37
554	555	Aug	1867477	0.95	1.65	1.38
555	556	Aug	1594002	1.03	1.65	1.23
556	557		1613750	1.02	1.63	1.37
		Sep				
557	558	Sep	2032965	0.95	1.61	1.33
558	559	Sep	1745274	1.06	1.64	1.41
559	560	Sep	1679836	1.03	1.67	1.36
560	561	Sep	1792941	0.99	1.71	1.36
561	562	Oct	1890071	0.97	1.64	1.29
562	563	Oct	1854960	0.99	1.73	1.24
563	564	Oct	1681291	1.00	1.68	1.32
564	565	Oct	1570368	0.99	1.78	1.31
565	566	Nov	1570216	1.00	1.76	1.21
566	567	Nov	1737014	0.97	1.86	1.30
567	568	Nov	1428985	1.06	1.75	1.31
568	569	Nov	1076198	1.10	1.77	1.38
569	570	Dec	1523707	1.00	1.83	1.31
570	571					
		Dec	1579472	1.00	1.88	1.28
571	572	Dec	1223610	1.07	1.85	1.25
572	573	Dec	1092610	1.04	1.90	1.40

	LNWEEK	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	\
0	0.000000	1	0	0	0	0	0	0	0	0	0	0	
1	0.693147	1	0	0	0	0	0	0	0	0	0	0	
2	1.098612	1	0	0	0	0	0	0	0	0	0	0	
3	1.386294	1	0	0	0	0	0	0	0	0	0	0	
4	1.609438	0	1	0	0	0	0	0	0	0	0	0	
5	1.791759	0	1	0	0	0	0	0	0	0	0	0	
6	1.945910	0	1	0	0	0	0	0	0	0	0	0	
7	2.079442	0	1	0	0	0	0	0	0	0	0	0	
8	2.197225	0	0	1	0	0	0	0	0	0	0	0	
9	2.302585	0	0	1	0	0	0	0	0	0	0	0	
10	2.397895	0	0	1	0	0	0	0	0	0	0	0	
11	2.484907	0	0	1	0	0	0	0	0	0	0	0	
12	2.564949	0	0	1	0	0	0	0	0	0	0	0	
13	2.639057	0	0	0	1	0	0	0	0	0	0	0	
14	2.708050	0	0	0	1	0	0	0	0	0	0	0	
15	2.772589	0	0	0	1	0	0	0	0	0	0	0	
16	2.833213	0	0	0	1	0	0	0	0	0	0	0	
17	2.890372	0	0	0	0	1	0	0	0	0	0	0	
18	2.944439	0	0	0	0	1	0	0	0	0	0	0	
19	2.995732	0	0	0	0	1	0	0	0	0	0	0	
20	3.044522	0	0	0	0	1	0	0	0	0	0	0	
21	3.091042	0	0	0	0	1	0	0	0	0	0	0	
22	3.135494	0	0	0	0	0	1	0	0	0	0	0	
23	3.133494	0	0	0	0	0	1	0	0	0	0		
		_		_		_						0	
24	3.218876	0	0	0	0	0	1	0	0	0	0	0	
25	3.258097	0	0	0	0	0	1	0	0	0	0	0	
26	3.295837	0	0	0	0	0	0	1	0	0	0	0	
27	3.332205	0	0	0	0	0	0	1	0	0	0	0	
28	3.367296	0	0	0	0	0	0	1	0	0	0	0	
29	3.401197	0	0	0	0	0	0	1	0	0	0	0	
 E49		• • •	• • •	• • •	• • •	• • •		• • •	• • •	• • •	• • •	• • •	
543	6.298949	0	0	0	0	0	1	0	0	0	0	0	
544	6.300786	0	0	0	0	0	1	0	0	0	0	0	
545	6.302619	0	0	0	0	0	1	0	0	0	0	0	
546	6.304449	0	0	0	0	0	1	0	0	0	0	0	
547	6.306275	0	0	0	0	0	1	0	0	0	0	0	
548	6.308098	0	0	0	0	0	0	1	0	0	0	0	
549	6.309918	0	0	0	0	0	0	1	0	0	0	0	
550	6.311735	0	0	0	0	0	0	1	0	0	0	0	
551	6.313548	0	0	0	0	0	0	1	0	0	0	0	
552	6.315358	0	0	0	0	0	0	0	1	0	0	0	
553	6.317165	0	0	0	0	0	0	0	1	0	0	0	
554	6.318968	0	0	0	0	0	0	0	1	0	0	0	
555	6.320768	0	0	0	0	0	0	0	1	0	0	0	
556	6.322565	0	0	0	0	0	0	0	0	1	0	0	
557	6.324359	0	0	0	0	0	0	0	0	1	0	0	
558	6.326149	0	0	0	0	0	0	0	0	1	0	0	

559	6.327937	0	0	0	0	0	0	0	0	1	0	0
560	6.329721	0	0	0	0	0	0	0	0	1	0	0
561	6.331502	0	0	0	0	0	0	0	0	0	1	0
562	6.333280	0	0	0	0	0	0	0	0	0	1	0
563	6.335054	0	0	0	0	0	0	0	0	0	1	0
564	6.336826	0	0	0	0	0	0	0	0	0	1	0
565	6.338594	0	0	0	0	0	0	0	0	0	0	1
566	6.340359	0	0	0	0	0	0	0	0	0	0	1
567	6.342121	0	0	0	0	0	0	0	0	0	0	1
568	6.343880	0	0	0	0	0	0	0	0	0	0	1
569	6.345636	0	0	0	0	0	0	0	0	0	0	0
570	6.347389	0	0	0	0	0	0	0	0	0	0	0
571	6.349139	0	0	0	0	0	0	0	0	0	0	0
572	6.350886	0	0	0	0	0	0	0	0	0	0	0

	Monthly	Dummy Effects
0		416788.905078
1		416788.905078
2		416788.905078
3		416788.905078
4		457736.148745
5		457736.148745
6		457736.148745
7		457736.148745
8		476321.069384
9		476321.069384
10		476321.069384
11		476321.069384
12		476321.069384
13		426062.711488
14		426062.711488
15		426062.711488
16		426062.711488
17		420077.724684
18		420077.724684
19		420077.724684
20		420077.724684
21		420077.724684
22		363990.520966
23		363990.520966
24		363990.520966
25		363990.520966
26		343386.604344
27		343386.604344
28		343386.604344
29		343386.604344
543		363990.520966

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546
                       363990.520966
         547
                       363990.520966
         548
                       343386.604344
         549
                       343386.604344
         550
                       343386.604344
         551
                       343386.604344
         552
                       406551.827621
         553
                       406551.827621
                       406551.827621
         554
         555
                       406551.827621
         556
                       453551.117530
         557
                       453551.117530
         558
                       453551.117530
         559
                       453551.117530
         560
                       453551.117530
         561
                       349466.722548
         562
                       349466.722548
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                       349466.722548
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                       349466.722548
         565
                       139042.340772
         566
                       139042.340772
                       139042.340772
         567
         568
                       139042.340772
         569
                             0.00000
         570
                             0.000000
         571
                             0.00000
         572
                             0.000000
         [573 rows x 19 columns]
In [11]: newdf['PREDICTED YOPLAIT UNITS'] = newdf['Monthly Dummy Effects'] + intercept + Para_
              'YOPLAIT_PRICE'] + Para_Est.iloc[2,1] * newdf['DANNON_PRICE'] + Para_Est.iloc[3,1]
              'CHOBANI_PRICE'] + Para_Est.iloc[4,1] * newdf['LNWEEK']
         newdf
         #Add 'PREDICTED YOPLAIT UNITS'
Out[11]:
               WEEK MONTH
                           YOPLAIT_UNITS
                                           YOPLAIT_PRICE
                                                           DANNON_PRICE
                                                                          CHOBANI_PRICE
         0
                                                     0.76
                                                                                    0.00
                  1
                      Jan
                                  1431790
                                                                    1.04
         1
                  2
                      Jan
                                  1549503
                                                     0.80
                                                                    0.94
                                                                                    0.00
         2
                  3
                                                     0.83
                                                                    1.02
                                                                                    0.00
                      Jan
                                  1448646
         3
                  4
                      Jan
                                                     0.82
                                                                                    0.00
                                  1398011
                                                                    1.10
         4
                  5
                      Feb
                                  1525899
                                                     0.81
                                                                    1.10
                                                                                    0.00
         5
                  6
                                                                                    0.00
                      Feb
                                  1315745
                                                     0.87
                                                                    0.89
         6
                  7
                      Feb
                                  1247943
                                                     0.87
                                                                    1.00
                                                                                    0.00
         7
                  8
                                  1206063
                                                     0.89
                                                                                    0.00
                      Feb
                                                                    1.06
         8
                  9
                                                                                    0.00
                      Mar
                                  1541804
                                                     0.85
                                                                    1.11
```

544

545

363990.520966

363990.520966

9	10	Mar	1493644	0.83	1.11	0.00
10	11	Mar	1355595	0.87	0.93	0.00
11	12	Mar	1309235	0.91	1.09	0.00
12	13	Mar	1370437	0.87	1.11	0.00
13	14	Apr	1498930	0.84	1.02	0.00
14	15	Apr	1321056	0.89	1.10	0.00
15	16	Apr	1203680	0.87	0.97	0.00
16	17	Apr	1236598	0.94	0.94	0.00
17	18	May	1493550	0.88	1.11	0.00
18	19	May	1262692	0.95	1.02	0.00
19	20	May	1365748	0.87	0.93	0.00
20	21	May	1283943	0.92	1.08	0.00
21	22	May	1373136	0.86	1.03	0.00
22	23	Jun	1550108	0.84	0.94	0.00
23	24	Jun	1411876	0.84	1.06	0.00
24	25	Jun	1277361	0.87	0.99	0.00
25	26	Jun	1158561	0.87	1.05	0.00
	27		1259457			
26		Jul		0.88	1.09	0.00
27	28	Jul	1175128	0.92	0.96	0.00
28	29	Jul	1310654	0.87	1.04	0.00
29	30	Jul	1264448	0.88	1.10	0.00
	 [44	· · ·	1002041			
543	544	Jun	1903941	0.85	1.56	1.40
544	545	Jun	1654621	0.97	1.54	1.39
545	546	Jun	1737019	0.93	1.42	1.40
546	547	Jun -	1759658	0.91	1.66	1.40
547	548	Jun	1746264	0.91	1.63	1.41
548	549	Jul	1615631	0.99	1.54	1.41
549	550	Jul	1851221	0.93	1.60	1.40
550	551	Jul	1898320	0.89	1.61	1.41
551	552	Jul	1509453	0.99	1.50	1.39
552	553	Aug	1879026	0.95	1.65	1.28
553	554	Aug	2025709	0.97	1.58	1.37
554	555	Aug	1867477	0.95	1.65	1.38
555	556	Aug	1594002	1.03	1.65	1.23
556	557	Sep	1613750	1.02	1.63	1.37
557	558	Sep	2032965	0.95	1.61	1.33
558	559	Sep	1745274	1.06	1.64	1.41
559	560	Sep	1679836	1.03	1.67	1.36
560	561	Sep	1792941	0.99	1.71	1.36
561	562	Oct	1890071	0.97	1.64	1.29
562	563	Oct	1854960	0.99	1.73	1.24
563	564	Oct	1681291	1.00	1.68	1.32
564	565	Oct	1570368	0.99	1.78	1.31
565	566	Nov	1570216	1.00	1.76	1.21
566	567	Nov	1737014	0.97	1.86	1.30
567	568	Nov	1428985	1.06	1.75	1.31
568	569	Nov	1076198	1.10	1.77	1.38

569 570 571 572	570 571 572 573	Dec Dec Dec Dec	15237071.0015794721.0012236101.0710926101.04			1.83 1.88 1.85 1.90				1.31 1.28 1.25 1.40			
_	LNWEE			Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	\
0	0.00000			0	0	0	0	0	0	0	0	0	
1	0.69314			0	0	0	0	0	0	0	0	0	
2	1.09861			0	0	0	0	0	0	0	0	0	
3	1.38629			0	0	0	0	0	0	0	0	0	
4	1.60943			0	0	0	0	0	0	0	0	0	
5	1.79175			0	0	0	0	0	0	0	0	0	
6	1.94591			0	0	0	0	0	0	0	0	0	
7	2.07944			0	0	0	0	0	0	0	0	0	
8	2.19722			1	0	0	0	0	0	0	0	0	
9	2.30258			1	0	0	0	0	0	0	0	0	
10	2.39789			1	0	0	0	0	0	0	0	0	
11	2.48490			1	0	0	0	0	0	0	0	0	
12	2.56494			1	0	0	0	0	0	0	0	0	
13	2.63905			0	1	0	0	0	0	0	0	0	
14	2.70805			0	1	0	0	0	0	0	0	0	
15	2.77258			0	1	0	0	0	0	0	0	0	
16	2.83321			0	1	0	0	0	0	0	0	0	
17	2.89037			0	0	1	0	0	0	0	0	0	
18	2.94443			0	0	1	0	0	0	0	0	0	
19	2.99573			0	0	1	0	0	0	0	0	0	
20	3.04452		0	0	0	1	0	0	0	0	0	0	
21	3.09104		0	0	0	1	0	0	0	0	0	0	
22	3.13549			0	0	0	1	0	0	0	0	0	
23	3.17805		0	0	0	0	1	0	0	0	0	0	
24	3.21887			0	0	0	1	0	0	0	0	0	
25	3.25809		0	0	0	0	1	0	0	0	0	0	
26	3.29583	37 C	0	0	0	0	0	1	0	0	0	0	
27	3.33220		0	0	0	0	0	1	0	0	0	0	
28	3.36729		0	0	0	0	0	1	0	0	0	0	
29	3.40119	97 C	0	0	0	0	0	1	0	0	0	0	
							• • •			• • •			
543	6.29894			0	0	0	1	0	0	0	0	0	
544	6.30078			0	0	0	1	0	0	0	0	0	
545	6.30261			0	0	0	1	0	0	0	0	0	
546	6.30444			0	0	0	1	0	0	0	0	0	
547	6.30627			0	0	0	1	0	0	0	0	0	
548	6.30809			0	0	0	0	1	0	0	0	0	
549	6.30991			0	0	0	0	1	0	0	0	0	
550	6.31173			0	0	0	0	1	0	0	0	0	
551	6.31354			0	0	0	0	1	0	0	0	0	
552	6.31535			0	0	0	0	0	1	0	0	0	
553	6.31716	65 C	0	0	0	0	0	0	1	0	0	0	

554	6.318968	0	0	0	0	0	0	0	1	0	0	0
555	6.320768	0	0	0	0	0	0	0	1	0	0	0
556	6.322565	0	0	0	0	0	0	0	0	1	0	0
557	6.324359	0	0	0	0	0	0	0	0	1	0	0
558	6.326149	0	0	0	0	0	0	0	0	1	0	0
559	6.327937	0	0	0	0	0	0	0	0	1	0	0
560	6.329721	0	0	0	0	0	0	0	0	1	0	0
561	6.331502	0	0	0	0	0	0	0	0	0	1	0
562	6.333280	0	0	0	0	0	0	0	0	0	1	0
563	6.335054	0	0	0	0	0	0	0	0	0	1	0
564	6.336826	0	0	0	0	0	0	0	0	0	1	0
565	6.338594	0	0	0	0	0	0	0	0	0	0	1
566	6.340359	0	0	0	0	0	0	0	0	0	0	1
567	6.342121	0	0	0	0	0	0	0	0	0	0	1
568	6.343880	0	0	0	0	0	0	0	0	0	0	1
569	6.345636	0	0	0	0	0	0	0	0	0	0	0
570	6.347389	0	0	0	0	0	0	0	0	0	0	0
571	6.349139	0	0	0	0	0	0	0	0	0	0	0
572	6.350886	0	0	0	0	0	0	0	0	0	0	0

	Monthly	Dummy Effects	PREDICTED	YOPLAIT UNITS
0	·	416788.905078		1.353762e+06
1		416788.905078		1.282463e+06
2		416788.905078		1.223484e+06
3		416788.905078		1.318253e+06
4		457736.148745		1.437371e+06
5		457736.148745		1.190714e+06
6		457736.148745		1.223827e+06
7		457736.148745		1.163529e+06
8		476321.069384		1.376947e+06
9		476321.069384		1.479659e+06
10		476321.069384		1.307870e+06
11		476321.069384		1.162175e+06
12		476321.069384		1.348654e+06
13		426062.711488		1.432007e+06
14		426062.711488		1.233962e+06
15		426062.711488		1.319776e+06
16		426062.711488		1.025412e+06
17		420077.724684		1.300532e+06
18		420077.724684		1.000301e+06
19		420077.724684		1.345669e+06
20		420077.724684		1.150087e+06
21		420077.724684		1.411789e+06
22		363990.520966		1.441580e+06
23		363990.520966		1.457945e+06
24		363990.520966		1.329518e+06
25		363990.520966		1.168247e+06
26		343386.604344		1.286010e+06

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28
                       343386.604344
                                                  1.336291e+06
         29
                       343386.604344
                                                  1.303390e+06
         . .
         543
                       363990.520966
                                                  2.304337e+06
         544
                       363990.520966
                                                  1.783628e+06
         545
                       363990.520966
                                                  1.949081e+06
         546
                       363990.520966
                                                  2.054847e+06
         547
                       363990.520966
                                                  2.055276e+06
         548
                       343386.604344
                                                  1.683154e+06
                       343386.604344
                                                  1.944131e+06
         549
         550
                       343386.604344
                                                  2.120057e+06
         551
                       343386.604344
                                                  1.675670e+06
         552
                       406551.827621
                                                  1.895336e+06
         553
                       406551.827621
                                                  1.826871e+06
                       406551.827621
                                                  1.921493e+06
         554
         555
                       406551.827621
                                                  1.538841e+06
                       453551.117530
                                                  1.663405e+06
         556
                                                  1.953323e+06
                       453551.117530
         557
                       453551.117530
                                                  1.502734e+06
         558
         559
                       453551.117530
                                                  1.621845e+06
         560
                       453551.117530
                                                  1.797625e+06
         561
                       349466.722548
                                                  1.756406e+06
         562
                       349466.722548
                                                  1.665006e+06
                       349466.722548
                                                  1.638658e+06
         563
                       349466.722548
                                                  1.687505e+06
         564
         565
                       139042.340772
                                                  1.407089e+06
         566
                       139042.340772
                                                  1.567662e+06
         567
                       139042.340772
                                                  1.174013e+06
         568
                       139042.340772
                                                  1.021538e+06
                            0.000000
                                                  1.300384e+06
         569
         570
                            0.000000
                                                  1.297013e+06
         571
                            0.000000
                                                  9.857110e+05
                            0.000000
                                                  1.157605e+06
         572
         [573 rows x 20 columns]
In [12]: Residual = newdf["YOPLAIT_UNITS"] - newdf["PREDICTED YOPLAIT UNITS"]
         res_df = 557 #Based on the regression results
         RSE= np.sqrt(np.sum(Residual ** 2/res df))
         RSE #Residual Standard Error
Out[12]: 167734.90963009506
In [13]: newdf['95PI_L'] = newdf['PREDICTED YOPLAIT UNITS'] - 2 * RSE
         newdf['95PI_U'] = newdf['PREDICTED YOPLAIT UNITS'] + 2 * RSE
         newdf['MAPE'] = abs(newdf['PREDICTED YOPLAIT UNITS'] - newdf['YOPLAIT_UNITS'])/newdf[
         print("The the average Mean Absolute Percentage Error across 573 weeks was: {}".forma
```

1.108979e+06

27

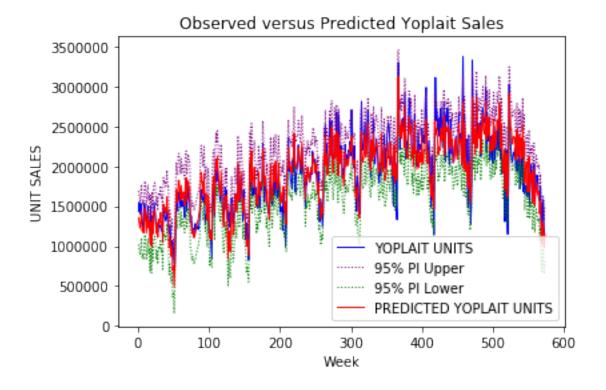
343386.604344

The the average Mean Absolute Percentage Error across 573 weeks was: 0.07259078870634533

```
In [14]: newdf1=newdf.iloc[:,[0,2,-2,-3,-4]]
    B1=newdf1.iloc[:,[0,1]]
    B2=newdf1.iloc[:,[0,2]]
    B3=newdf1.iloc[:,[0,3]]
    B4=newdf1.iloc[:,[0,4]]

In [15]: plt.plot(B1["WEEK"],B1["YOPLAIT_UNITS"],color="b",linewidth = 1)
    plt.plot(B2["WEEK"],B2["95PI_U"],color="purple",linewidth = 1,linestyle=':')
    plt.plot(B3["WEEK"],B3["95PI_L"],color="g",linewidth = 1,linestyle=':')
    plt.plot(B4["WEEK"],B4["PREDICTED YOPLAIT UNITS"],color="r",linewidth = 1)
    plt.title("Observed versus Predicted Yoplait Sales")
    plt.ylabel("UNIT SALES")
    plt.xlabel("Week")
    plt.legend(["YOPLAIT UNITS","95% PI Upper","95% PI Lower","PREDICTED YOPLAIT UNITS"])
    plt.figure(figsize=(20,10))
```

Out[15]: <Figure size 1440x720 with 0 Axes>



<Figure size 1440x720 with 0 Axes>

Graphical Analysis and MAPE calculation:

- 1.Using the estimated demand and the observed IVs (prices, ln(week), and within-year week index dummies), we predict Yoplait sales for each of the 573 weeks. We then plot it with the observed Yoplait sales (YOPLAIT UNITS) and the 95% PI upper and 95% PI lower interval.
- 2.It can be observed from the graph that the predicted sales explain the observed data pattern pretty well, except for extremely high or low observed values. We compute the Mean Absolute Percentage Error (MAPE) for each week, and then compute the average MAPE across 573 weeks. It was 7.26%, which is quite low.

Thus with confidence, we can use the estimated linear demand for the following analysis on price elasticities.

1.0.3 Change in Price Elasticities due to Chobani Entry

We use the weekly price elasticities and compute pre- and post-Chobani average own- and cross-price elasticities.

In	[16]	:	newdf
T-11	L + O J	•	II C W CL

Out[16]:	WEEK	MONTH	YOPLAIT_UNITS	YOPLAIT_PRICE	DANNON_PRICE	CHOBANI_PRICE	\
0	1	Jan	1431790	0.76	1.04	0.00	
1	2	Jan	1549503	0.80	0.94	0.00	
2	3	Jan	1448646	0.83	1.02	0.00	
3	4	Jan	1398011	0.82	1.10	0.00	
4	5	Feb	1525899	0.81	1.10	0.00	
5	6	Feb	1315745	0.87	0.89	0.00	
6	7	Feb	1247943	0.87	1.00	0.00	
7	8	Feb	1206063	0.89	1.06	0.00	
8	9	Mar	1541804	0.85	1.11	0.00	
9	10	Mar	1493644	0.83	1.11	0.00	
10	11	Mar	1355595	0.87	0.93	0.00	
11	12	Mar	1309235	0.91	1.09	0.00	
12	13	Mar	1370437	0.87	1.11	0.00	
13	14	Apr	1498930	0.84	1.02	0.00	
14	15	Apr	1321056	0.89	1.10	0.00	
15	16	Apr	1203680	0.87	0.97	0.00	
16	17	Apr	1236598	0.94	0.94	0.00	
17	18	May	1493550	0.88	1.11	0.00	
18	19	May	1262692	0.95	1.02	0.00	
19	20	May	1365748	0.87	0.93	0.00	
20	21	May	1283943	0.92	1.08	0.00	
21	22	May	1373136	0.86	1.03	0.00	
22	23	Jun	1550108	0.84	0.94	0.00	
23	24	Jun	1411876	0.84	1.06	0.00	
24	25	Jun	1277361	0.87	0.99	0.00	
25	26	Jun	1158561	0.91	1.05	0.00	
26	27	Jul	1259457	0.88	1.09	0.00	

27	28	Ju	1	1	175128		0.9	2		0.96			0.00
28	29	Ju	1	1	310654		0.8	37		1.04			0.00
29	30	Ju	1	1	264448		0.8	88		1.10			0.00
543	544	Ju	n	1	903941		0.8	35		1.56			1.40
544	545	Ju	n	1	654621		0.9	7		1.54			1.39
545	546	Ju			737019		0.9			1.42			1.40
546	547	Ju			759658		0.9			1.66			1.40
547	548	Ju			746264		0.9			1.63			1.41
548	549	Ju			615631		0.9			1.54			1.41
549	550	Ju			851221		0.9			1.60			1.40
550	551	Ju			898320		0.8			1.61			1.41
551	552	Ju			509453		0.9			1.50			1.39
552	553	Au			879026		0.9			1.65			1.28
553	554	Au	_		025709		0.9			1.58			1.37
554	555		-		867477		0.9			1.65			1.38
		Au	_		594002								
555 556	556	Au	_				1.0			1.65			1.23
556	557	Se	_		613750		1.0			1.63			1.37
557	558	Se			032965		0.9			1.61			1.33
558	559	Se	_		745274		1.0			1.64			1.41
559	560	Se	_		679836		1.0			1.67			1.36
560	561	Se			792941		0.9			1.71			1.36
561	562	0c			890071		0.9			1.64			1.29
562	563	0c			854960		0.9			1.73			1.24
563	564	0c			681291		1.0			1.68			1.32
564	565	0c			570368		0.9			1.78			1.31
565	566	No			570216		1.0			1.76			1.21
566	567	No			737014		0.9			1.86			1.30
567	568	No	V	1	428985		1.0	6		1.75			1.31
568	569	No	V	1	076198		1.1	.0		1.77			1.38
569	570	De	С	1	523707		1.0	0		1.83			1.31
570	571	De	С	1	579472		1.0	0		1.88			1.28
571	572	De	С	1	223610		1.0	7		1.85			1.25
572	573	De	С	1	092610		1.0	14		1.90			1.40
	LNWI	EEK	Jan	Feb	Mar		Jul	Aug	Sep	Oct	Nov	\	
0	0.0000	000	1	0	0		0	0	0	0	0		
1	0.693	147	1	0	0		0	0	0	0	0		
2	1.0986	312	1	0	0		0	0	0	0	0		
3	1.3862		1	0	0		0	0	0	0	0		
4	1.6094		0	1	0		0	0	0	0	0		
5	1.7917		0	1	0		0	0	0	0	0		
6	1.9459		0	1	0		0	0	0	0	0		
7	2.0794		0	1	0		0	0	0	0	0		
8	2.1972		0	0	1		0	0	0	0	0		
9	2.302		0	0	1		0	0	0	0	0		
10	2.3978		0	0	1	•••	0	0	0	0	0		
11	2.4849		0	0	1		0	0	0	0	0		
	2.101		0	0	_	• • •	J	0	0	U	0		

12	2.564949	0	0	1	 0	0	0	0	0
13	2.639057	0	0	0	 0	0	0	0	0
14	2.708050	0	0	0	 0	0	0	0	0
15	2.772589	0	0	0	 0	0	0	0	0
16	2.833213	0	0	0	 0	0	0	0	0
17	2.890372	0	0	0	 0	0	0	0	0
18	2.944439	0	0	0	 0	0	0	0	0
19	2.995732	0	0	0	 0	0	0	0	0
20	3.044522	0	0	0	 0	0	0	0	0
21	3.091042	0	0	0	 0	0	0	0	0
22	3.135494	0	0	0	 0	0	0	0	0
23	3.178054	0	0	0	 0	0	0	0	0
24	3.218876	0	0	0	 0	0	0	0	0
25	3.258097	0	0	0	 0	0	0	0	0
26	3.295837	0	0	0	 1	0	0	0	0
27	3.332205	0	0	0	 1	0	0	0	0
28	3.367296	0	0	0	 1	0	0	0	0
29	3.401197	0	0	0	 1	0	0	0	0
543	6.298949	0	0	0	 0	0	0	0	0
544	6.300786	0	0	0	 0	0	0	0	0
545	6.302619	0	0	0	 0	0	0	0	0
546	6.304449	0	0	0	 0	0	0	0	0
547	6.306275	0	0	0	 0	0	0	0	0
548	6.308098	0	0	0	 1	0	0	0	0
549	6.309918	0	0	0	 1	0	0	0	0
550	6.311735	0	0	0	 1	0	0	0	0
551	6.313548	0	0	0	 1	0	0	0	0
552	6.315358	0	0	0	 0	1	0	0	0
553	6.317165	0	0	0	 0	1	0	0	0
554	6.318968	0	0	0	 0	1	0	0	0
555	6.320768	0	0	0	 0	1	0	0	0
556	6.322565	0	0	0	 0	0	1	0	0
557	6.324359	0	0	0	 0	0	1	0	0
558	6.326149	0	0	0	 0	0	1	0	0
559	6.327937	0	0	0	 0	0	1	0	0
560	6.329721	0	0	0	 0	0	1	0	0
561	6.331502	0	0	0	 0	0	0	1	0
562	6.333280	0	0	0	 0	0	0	1	0
563	6.335054	0	0	0	 0	0	0	1	0
564	6.336826	0	0	0	 0	0	0	1	0
565	6.338594	0	0	0	 0	0	0	0	1
566	6.340359	0	0	0	 0	0	0	0	1
567	6.342121	0	0	0	 0	0	0	0	1
568	6.343880	0	0	0	 0	0	0	0	1
569	6.345636	0	0	0	 0	0	0	0	0
570	6.347389	0	0	0	 0	0	0	0	0
571	6.349139	0	0	0	 0	0	0	0	0

572 6.350886 0 0 0 ... 0 0 0 0

	Monthly	Dummy Effects	PREDICTED	YOPLAIT UNITS	95PI_L	\
0	v	416788.905078		1.353762e+06	1.018292e+06	
1		416788.905078		1.282463e+06	9.469929e+05	
2		416788.905078		1.223484e+06	8.880141e+05	
3		416788.905078		1.318253e+06	9.827834e+05	
4		457736.148745		1.437371e+06	1.101901e+06	
5		457736.148745		1.190714e+06	8.552444e+05	
6		457736.148745		1.223827e+06	8.883572e+05	
7		457736.148745		1.163529e+06	8.280593e+05	
8		476321.069384		1.376947e+06	1.041477e+06	
9		476321.069384		1.479659e+06	1.144189e+06	
10		476321.069384		1.307870e+06	9.724003e+05	
11		476321.069384		1.162175e+06	8.267052e+05	
12		476321.069384		1.348654e+06	1.013184e+06	
13		426062.711488		1.432007e+06	1.096537e+06	
14		426062.711488		1.233962e+06	8.984920e+05	
15		426062.711488		1.319776e+06	9.843062e+05	
16		426062.711488		1.025412e+06	6.899423e+05	
17		420077.724684		1.300532e+06	9.650618e+05	
18		420077.724684		1.000301e+06	6.648313e+05	
19		420077.724684		1.345669e+06	1.010199e+06	
20		420077.724684		1.150087e+06	8.146169e+05	
21		420077.724684		1.411789e+06	1.076319e+06	
22		363990.520966		1.441580e+06	1.106110e+06	
23		363990.520966		1.457945e+06	1.122475e+06	
24		363990.520966		1.329518e+06	9.940485e+05	
25		363990.520966		1.168247e+06	8.327772e+05	
26		343386.604344		1.286010e+06	9.505403e+05	
27		343386.604344		1.108979e+06	7.735092e+05	
28		343386.604344		1.336291e+06	1.000821e+06	
29		343386.604344		1.303390e+06	9.679198e+05	
		343300.004344		1.5055506100	9.079190e103	
 543		363990.520966		2 30/3370±06	1.968868e+06	
544		363990.520966		1.783628e+06	1.448158e+06	
545		363990.520966		1.949081e+06	1.613611e+06	
546		363990.520966		2.054847e+06	1.719377e+06	
547		363990.520966		2.054847e+06 2.055276e+06	1.719806e+06	
548 540		343386.604344		1.683154e+06	1.347684e+06	
549		343386.604344		1.944131e+06	1.608661e+06	
550		343386.604344		2.120057e+06	1.784587e+06	
551		343386.604344		1.675670e+06	1.340200e+06	
552		406551.827621		1.895336e+06	1.559867e+06	
553		406551.827621		1.826871e+06	1.491402e+06	
554		406551.827621		1.921493e+06	1.586023e+06	
555		406551.827621		1.538841e+06	1.203372e+06	
556		453551.117530		1.663405e+06	1.327935e+06	

```
557
              453551.117530
                                         1.953323e+06
                                                        1.617853e+06
558
              453551.117530
                                         1.502734e+06
                                                        1.167264e+06
              453551.117530
                                         1.621845e+06
                                                        1.286375e+06
559
              453551.117530
                                         1.797625e+06
                                                        1.462155e+06
560
561
              349466.722548
                                         1.756406e+06
                                                        1.420936e+06
              349466.722548
562
                                         1.665006e+06
                                                        1.329536e+06
563
              349466.722548
                                         1.638658e+06
                                                        1.303188e+06
564
              349466.722548
                                         1.687505e+06
                                                        1.352035e+06
              139042.340772
565
                                         1.407089e+06
                                                        1.071620e+06
566
              139042.340772
                                         1.567662e+06
                                                        1.232192e+06
              139042.340772
                                         1.174013e+06
                                                        8.385433e+05
567
568
              139042.340772
                                         1.021538e+06
                                                        6.860678e+05
                   0.000000
                                         1.300384e+06
569
                                                        9.649145e+05
570
                   0.000000
                                         1.297013e+06
                                                        9.615429e+05
571
                   0.000000
                                         9.857110e+05
                                                        6.502412e+05
572
                   0.000000
                                         1.157605e+06
                                                        8.221350e+05
           95PI_U
                        MAPE
0
     1.689232e+06
                    0.054497
1
     1.617933e+06
                    0.172339
2
     1.558954e+06
                    0.155429
3
     1.653723e+06
                    0.057051
4
     1.772841e+06
                    0.058017
5
     1.526184e+06
                    0.095027
6
     1.559297e+06
                    0.019325
7
     1.498999e+06
                    0.035267
8
     1.712417e+06
                    0.106925
9
     1.815128e+06
                    0.009363
10
     1.643340e+06
                    0.035206
11
     1.497645e+06
                    0.112325
12
     1.684123e+06
                    0.015895
13
     1.767477e+06
                    0.044647
14
     1.569432e+06
                    0.065928
     1.655246e+06
15
                    0.096451
16
     1.360882e+06
                    0.170780
17
     1.636001e+06
                    0.129235
18
     1.335771e+06
                    0.207803
19
     1.681139e+06
                    0.014702
20
     1.485557e+06
                    0.104254
21
     1.747259e+06
                    0.028150
22
     1.777050e+06
                    0.070013
23
     1.793415e+06
                    0.032629
24
     1.664988e+06
                    0.040832
25
     1.503717e+06
                    0.008360
26
     1.621480e+06
                    0.021083
27
     1.444449e+06
                    0.056291
28
     1.671761e+06
                    0.019560
```

0.030797

29

1.638859e+06

```
543
    2.639807e+06
                 0.210299
544 2.119098e+06 0.077968
    2.284551e+06 0.122084
545
546 2.390317e+06
                0.167754
    2.390746e+06 0.176956
548 2.018624e+06 0.041794
549 2.279600e+06 0.050188
550 2.455527e+06 0.116807
551 2.011140e+06 0.110118
552 2.230806e+06 0.008680
553 2.162341e+06
                 0.098157
554
   2.256963e+06
                 0.028925
555 1.874311e+06
                 0.034605
556 1.998874e+06
                 0.030770
557 2.288792e+06
                0.039176
558 1.838204e+06 0.138970
559
    1.957315e+06 0.034522
560 2.133095e+06 0.002612
561 2.091876e+06
                0.070720
562 2.000476e+06 0.102403
563 1.974127e+06 0.025357
564 2.022975e+06 0.074592
565 1.742559e+06 0.103888
566 1.903132e+06 0.097496
567 1.509483e+06 0.178429
568
   1.357007e+06
                 0.050790
569
   1.635854e+06
                 0.146565
570 1.632483e+06
                  0.178831
571
    1.321181e+06
                  0.194424
572 1.493075e+06
                  0.059486
```

[573 rows x 23 columns]

Out[17]:	WEEK N	HTNON	YOPLAIT_UNITS	YOPLAIT_PRICE	DANNON_PRICE	CHOBANI_PRICE	\
0	1	Jan	1431790	0.76	1.04	0.00	
1	2	Jan	1549503	0.80	0.94	0.00	
2	3	Jan	1448646	0.83	1.02	0.00	
3	4	Jan	1398011	0.82	1.10	0.00	
4	5	Feb	1525899	0.81	1.10	0.00	
5	6	Feb	1315745	0.87	0.89	0.00	
6	7	Feb	1247943	0.87	1.00	0.00	
7	8	Feb	1206063	0.89	1 06	0.00	

8	9	Mar	1541804	0.85	1.11	0.00
9	10	Mar	1493644	0.83	1.11	0.00
10	11	Mar	1355595	0.87	0.93	0.00
11	12	Mar	1309235	0.91	1.09	0.00
12	13	Mar	1370437	0.87	1.11	0.00
13	14	Apr	1498930	0.84	1.02	0.00
14	15	Apr	1321056	0.89	1.10	0.00
15	16	Apr	1203680	0.87	0.97	0.00
16	17	Apr	1236598	0.94	0.94	0.00
17	18	May	1493550	0.88	1.11	0.00
18	19	May	1262692	0.95	1.02	0.00
19	20	May	1365748	0.87	0.93	0.00
20	21	May	1283943	0.92	1.08	0.00
21	22	•	1373136	0.86	1.03	0.00
22	23	May Jun	1550108	0.84	0.94	0.00
			1411876			
23	24	Jun		0.84	1.06	0.00
24	25 26	Jun	1277361	0.87	0.99	0.00
25	26	Jun	1158561	0.91	1.05	0.00
26	27	Jul	1259457	0.88	1.09	0.00
27	28	Jul	1175128	0.92	0.96	0.00
28	29	Jul	1310654	0.87	1.04	0.00
29	30	Jul	1264448	0.88	1.10	0.00
• •			• • •		• • •	• • •
543	544	Jun	1903941	0.85	1.56	1.40
544	545	Jun	1654621	0.97	1.54	1.39
545	546	Jun	1737019	0.93	1.42	1.40
546	547	Jun	1759658	0.91	1.66	1.40
547	548	Jun	1746264	0.91	1.63	1.41
548	549	Jul	1615631	0.99	1.54	1.41
549	550	Jul	1851221	0.93	1.60	1.40
550	551	Jul	1898320	0.89	1.61	1.41
551	552	Jul	1509453	0.99	1.50	1.39
552	553	Aug	1879026	0.95	1.65	1.28
553	554	Aug	2025709	0.97	1.58	1.37
554	555	Aug	1867477	0.95	1.65	1.38
555	556	Aug	1594002	1.03	1.65	1.23
556	557	Sep	1613750	1.02	1.63	1.37
557	558	Sep	2032965	0.95	1.61	1.33
558	559	Sep	1745274	1.06	1.64	1.41
559	560	Sep	1679836	1.03	1.67	1.36
560	561	Sep	1792941	0.99	1.71	1.36
561	562	Oct	1890071	0.97	1.64	1.29
562	563	Oct	1854960	0.99	1.73	1.24
563	564	Oct	1681291	1.00	1.68	1.32
564	565	Oct	1570368	0.99	1.78	1.31
565	566	Nov	1570216	1.00	1.76	1.21
566	567	Nov	1737014	0.97	1.86	1.30
567	568	Nov	1428985	1.06	1.75	1.31
001	000	14 O A	1 120000	1.00	1.10	1.01

568	569 N	ov	1	076198	1.10	1.77		1.38
569	570 D	ec	1	523707	1.00	1.83		1.31
570	571 D	ec	1	579472	1.00	1.88		1.28
571	572 D	ec	1	223610	1.07	1.85		1.25
572	573 D	ec	1	092610	1.04	1.90		1.40
_	LNWEEK		Feb	Mar		Oct	Nov	\
0	0.000000		0	0	• • •	0	0	
1	0.693147		0	0	• • •	0	0	
2	1.098612		0	0	• • •	0	0	
3	1.386294		0	0	• • •	0	0	
4	1.609438		1	0	• • •	0	0	
5	1.791759		1	0	• • •	0	0	
6	1.945910		1	0	• • •	0	0	
7	2.079442		1	0	• • •	0	0	
8	2.197225		0	1	• • •	0	0	
9	2.302585		0	1	• • •	0	0	
10	2.397895		0	1	• • •	0	0	
11	2.484907		0	1	• • •	0	0	
12	2.564949		0	1		0	0	
13	2.639057		0	0		0	0	
14	2.708050	0	0	0		0	0	
15	2.772589	0	0	0		0	0	
16	2.833213	0	0	0		0	0	
17	2.890372	. 0	0	0		0	0	
18	2.944439	0	0	0		0	0	
19	2.995732	. 0	0	0		0	0	
20	3.044522	. 0	0	0		0	0	
21	3.091042	. 0	0	0		0	0	
22	3.135494	. 0	0	0		0	0	
23	3.178054	. 0	0	0		0	0	
24	3.218876	0	0	0		0	0	
25	3.258097	0	0	0		0	0	
26	3.295837	0	0	0		0	0	
27	3.332205	0	0	0		0	0	
28	3.367296	0	0	0		0	0	
29	3.401197	0	0	0		0	0	
543	6.298949	0	0	0		0	0	
544	6.300786	0	0	0		0	0	
545	6.302619	0	0	0		0	0	
546	6.304449	0	0	0		0	0	
547	6.306275	0	0	0		0	0	
548	6.308098	0	0	0		0	0	
549	6.309918	0	0	0		0	0	
550	6.311735	0	0	0		0	0	
551	6.313548	0	0	0		0	0	
552	6.315358	0	0	0		0	0	

553	6.317165	0	0	0		0 0	
554	6.318968	0	0	0		0 0	
555	6.320768	0	0	0		0 0	
556	6.322565	0	0	0		0 0	
557	6.324359	0	0	0		0 0	
558	6.326149	0	0	0		0 0	
559	6.327937	0	0	0		0 0	
560	6.329721	. 0	0	0		0 0	
561	6.331502	2 0	0	0		1 0	
562	6.333280	0	0	0		1 0	
563	6.335054	0	0	0		1 0	
564	6.336826	0	0	0		1 0	
565	6.338594	. 0	0	0		0 1	
566	6.340359	0	0	0		0 1	
567	6.342121	. 0	0	0		0 1	
568	6.343880	0	0	0		0 1	
569	6.345636	0	0	0		0 0	
570	6.347389	0	0	0		0 0	
571	6.349139	0	0	0		0 0	
572	6.350886	0	0	0		0 0	
	Monthly	-		PREDICTED	YOPLAIT UNITS	-	\
0		41678	8.905078		1.353762e+06	1.018292e+06	
1		41678	8.905078		1.282463e+06	9.469929e+05	
2		41678	8.905078		1.223484e+06	8.880141e+05	
3		41678	8.905078		1.318253e+06	9.827834e+05	
4		45773	6.148745		1.437371e+06	1.101901e+06	
5			6.148745		1.190714e+06	8.552444e+05	
6			6.148745		1.223827e+06	8.883572e+05	
7			6.148745		1.163529e+06	8.280593e+05	
8			1.069384		1.376947e+06	1.041477e+06	
9			1.069384		1.479659e+06	1.144189e+06	
10			1.069384		1.307870e+06	9.724003e+05	
11			1.069384		1.162175e+06	8.267052e+05	
12			1.069384		1.348654e+06	1.013184e+06	
13			2.711488		1.432007e+06	1.096537e+06	
14			2.711488		1.233962e+06	8.984920e+05	
15			2.711488		1.319776e+06	9.843062e+05	
16			2.711488		1.025412e+06	6.899423e+05	
17			7.724684		1.300532e+06	9.650618e+05	
18			7.724684		1.000301e+06	6.648313e+05	
19			7.724684		1.345669e+06	1.010199e+06	
20			7.724684		1.150087e+06	8.146169e+05	
21			7.724684		1.411789e+06	1.076319e+06	
22			0.520966		1.441580e+06	1.106110e+06	
23			0.520966		1.457945e+06	1.122475e+06	
24			0.520966		1.329518e+06	9.940485e+05	
25		36399	0.520966		1.168247e+06	8.327772e+05	

```
26
              343386.604344
                                         1.286010e+06
                                                       9.505403e+05
27
              343386.604344
                                         1.108979e+06
                                                        7.735092e+05
28
              343386.604344
                                         1.336291e+06
                                                        1.000821e+06
29
              343386.604344
                                         1.303390e+06
                                                        9.679198e+05
. .
543
              363990.520966
                                         2.304337e+06
                                                        1.968868e+06
              363990.520966
                                         1.783628e+06
544
                                                        1.448158e+06
545
              363990.520966
                                         1.949081e+06
                                                        1.613611e+06
546
              363990.520966
                                         2.054847e+06
                                                        1.719377e+06
                                         2.055276e+06
                                                        1.719806e+06
547
              363990.520966
548
              343386.604344
                                         1.683154e+06
                                                        1.347684e+06
549
              343386.604344
                                         1.944131e+06
                                                        1.608661e+06
550
              343386.604344
                                         2.120057e+06
                                                        1.784587e+06
551
              343386.604344
                                         1.675670e+06
                                                        1.340200e+06
552
              406551.827621
                                         1.895336e+06
                                                        1.559867e+06
553
              406551.827621
                                         1.826871e+06
                                                        1.491402e+06
554
              406551.827621
                                         1.921493e+06
                                                        1.586023e+06
555
              406551.827621
                                         1.538841e+06
                                                        1.203372e+06
              453551.117530
                                         1.663405e+06
                                                        1.327935e+06
556
557
              453551.117530
                                         1.953323e+06
                                                        1.617853e+06
558
              453551.117530
                                         1.502734e+06
                                                        1.167264e+06
              453551.117530
                                         1.621845e+06
                                                        1.286375e+06
559
              453551.117530
560
                                         1.797625e+06
                                                        1.462155e+06
561
              349466.722548
                                         1.756406e+06
                                                        1.420936e+06
              349466.722548
562
                                         1.665006e+06
                                                        1.329536e+06
              349466.722548
563
                                         1.638658e+06
                                                        1.303188e+06
              349466.722548
                                         1.687505e+06
                                                        1.352035e+06
564
565
              139042.340772
                                         1.407089e+06
                                                        1.071620e+06
566
              139042.340772
                                         1.567662e+06
                                                        1.232192e+06
              139042.340772
                                         1.174013e+06
                                                        8.385433e+05
567
568
              139042.340772
                                         1.021538e+06
                                                        6.860678e+05
                   0.00000
                                         1.300384e+06
                                                        9.649145e+05
569
570
                   0.000000
                                         1.297013e+06
                                                        9.615429e+05
                   0.000000
                                         9.857110e+05
                                                        6.502412e+05
571
                                                        8.221350e+05
572
                   0.000000
                                         1.157605e+06
           95PI U
                                                Cross elasticity($Dannon)
                        MAPE
                               Own_elasticity
0
     1.689232e+06
                                    -2.417886
                    0.054497
                                                                  0.061907
1
     1.617933e+06
                    0.172339
                                    -2.686642
                                                                  0.059066
                   0.155429
2
     1.558954e+06
                                                                  0.067182
                                    -2.921759
3
     1.653723e+06
                    0.057051
                                    -2.679043
                                                                  0.067243
4
     1.772841e+06
                    0.058017
                                    -2.427062
                                                                  0.061670
5
     1.526184e+06
                    0.095027
                                    -3.146852
                                                                  0.060233
6
     1.559297e+06
                    0.019325
                                    -3.061708
                                                                  0.065846
7
     1.498999e+06
                    0.035267
                                    -3.294408
                                                                  0.073414
8
     1.712417e+06
                    0.106925
                                    -2.658682
                                                                  0.064962
9
     1.815128e+06
                    0.009363
                                    -2.415912
                                                                  0.060452
10
     1.643340e+06
                                    -2.864964
                   0.035206
                                                                  0.057302
```

	4 405045		0.00004	0 075500
11	1.497645e+06	0.112325	-3.372364	0.075580
12	1.684123e+06	0.015895	-2.778327	0.066324
13	1.767477e+06	0.044647	-2.526380	0.057399
14	1.569432e+06	0.065928	-3.106368	0.071836
15	1.655246e+06	0.096451	-2.839119	0.059227
16	1.360882e+06	0.170780	-3.948153	0.073872
17	1.636001e+06	0.129235	-2.914247	0.068779
18	1.335771e+06	0.207803	-4.090322	0.082171
19	1.681139e+06	0.014702	-2.784490	0.055692
20	1.485557e+06	0.104254	-3.445259	0.075674
21	1.747259e+06	0.028150	-2.623573	0.058792
22	1.777050e+06	0.070013	-2.509604	0.052546
23	1.793415e+06	0.032629	-2.481435	0.058589
24	1.664988e+06	0.032029	-2.818315	0.060006
25	1.503717e+06	0.008360	-3.354836	0.072428
26	1.621480e+06	0.021083	-2.947154	0.068302
27	1.444449e+06	0.056291	-3.572968	0.069759
28	1.671761e+06	0.019560	-2.804032	0.062717
29	1.638859e+06	0.030797	-2.907857	0.068009
• •	• • •	• • •	• • •	• • •
543	2.639807e+06	0.210299	-1.588684	0.054554
544	2.119098e+06	0.077968	-2.342244	0.069577
545	2.284551e+06	0.122084	-2.055028	0.058710
546	2.390317e+06	0.167754	-1.907333	0.065100
547	2.390746e+06	0.176956	-1.906935	0.063910
548	2.018624e+06	0.041794	-2.533237	0.073731
549	2.279600e+06	0.050188	-2.060261	0.066320
550	2.455527e+06	0.116807	-1.808036	0.061197
551	2.011140e+06	0.110118	-2.544551	0.072136
552	2.230806e+06	0.008680	-2.158748	0.070153
553	2.162341e+06	0.098157	-2.286801	0.069695
554	2.256963e+06	0.028925	-2.129362	0.069198
555	1.874311e+06	0.034605	-2.882757	0.086405
556	1.998874e+06	0.030770	-2.640991	0.078966
557	2.288792e+06	0.030776	-2.094663	0.066421
	1.838204e+06	0.039170		
558			-3.038005	0.087945
559	1.957315e+06	0.034522	-2.735221	0.082977
560	2.133095e+06	0.002612	-2.371924	0.076656
561	2.091876e+06	0.070720	-2.378545	0.075244
562	2.000476e+06	0.102403	-2.560849	0.083730
563	1.974127e+06	0.025357	-2.628309	0.082617
564	2.022975e+06	0.074592	-2.526706	0.085001
565	1.742559e+06	0.103888	-3.060856	0.100796
566	1.903132e+06	0.097496	-2.664918	0.095612
567	1.509483e+06	0.178429	-3.888638	0.120120
568	1.357007e+06	0.050790	-4.637703	0.139627
569	1.635854e+06	0.146565	-3.312019	0.113404
570	1.632483e+06	0.178831	-3.320629	0.116806

57	1 1.321181e+06	0.194424	-4.675185	0.151242
57	2 1.493075e+06	0.059486	-3.869347	0.132265
	Cross_elastic	ity(\$Chobani)		
0		0.000000		
1		0.000000		
2		0.000000		
3		0.000000		
4		0.000000		
5		0.000000		
6		0.000000		
7		0.000000		
8		0.000000		
9		0.000000		
10		0.000000		
11		0.000000		
12		0.000000		
13		0.000000		
14		0.000000		
15		0.000000		
16		0.000000		
17		0.000000		
18		0.000000		
19		0.000000		
20		0.000000		
21		0.000000		
22		0.000000		
23		0.000000		
24		0.000000		
25		0.000000		
26		0.000000		
27		0.000000		
28		0.000000		
29		0.000000		
54	3	0.155463		
54	4	0.199414		
54	5	0.183799		
54	6	0.174339		
54	7	0.175548		
54	8	0.214359		
54	9	0.184267		
55	0	0.170183		
55	1	0.212262		
55	2	0.172810		
55	3	0.191893		
	1	0 400775		

0.183775

0.204530

554

555

0.210750
0.174230
0.240095
0.214573
0.193591
0.187936
0.190569
0.206125
0.198642
0.220044
0.212196
0.285525
0.345677
0.257778
0.252529
0.324494
0.309466

[573 rows x 26 columns]

Out[18]:	WEEK	MONTH	YOPLAIT_UNITS	YOPLAIT_PRICE	DANNON_PRICE	CHOBANI_PRICE	\
0	1	Jan	1431790	0.76	1.04	0.0	
1	2	Jan	1549503	0.80	0.94	0.0	
2	3	Jan	1448646	0.83	1.02	0.0	
3	4	Jan	1398011	0.82	1.10	0.0	
4	5	Feb	1525899	0.81	1.10	0.0	
5	6	Feb	1315745	0.87	0.89	0.0	
6	7	Feb	1247943	0.87	1.00	0.0	
7	8	Feb	1206063	0.89	1.06	0.0	
8	9	Mar	1541804	0.85	1.11	0.0	
9	10	Mar	1493644	0.83	1.11	0.0	
10	11	Mar	1355595	0.87	0.93	0.0	
11	12	Mar	1309235	0.91	1.09	0.0	
12	13	Mar	1370437	0.87	1.11	0.0	
13	14	Apr	1498930	0.84	1.02	0.0	
14	15	Apr	1321056	0.89	1.10	0.0	
15	16	Apr	1203680	0.87	0.97	0.0	
16	17	Apr	1236598	0.94	0.94	0.0	
17	18	May	1493550	0.88	1.11	0.0	
18	19	May	1262692	0.95	1.02	0.0	
19	20	May	1365748	0.87	0.93	0.0	
20	21	May	1283943	0.92	1.08	0.0	
21	22	May	1373136	0.86	1.03	0.0	
22	23	Jun	1550108	0.84	0.94	0.0	
23	24	Jun	1411876	0.84	1.06	0.0	

24	25	Jun	L	1	277361	0	.87	0.99				0.0
25	26	Jun	L	1	158561	0	.91	1.05				0.0
26	27	Jul		1	259457	0	.88	1.09				0.0
27	28	Jul		1	175128	0	.92	0.96				0.0
28	29	Jul		1	310654	0	.87	1.04				0.0
29	30	Jul		1	264448	0	.88	1.10				0.0
325	326	Mar		2	010947	0	.82	1.15				0.0
326	327	Apr			072191		.83	1.33				0.0
327	328	Apr			860287		.84	1.20				0.0
328	329	Apr			308603		.75	1.17				0.0
329	330	Apr			085048		.81	1.14				0.0
330	331	May			328731		.77	1.17				0.0
331	332	May			594268		.73	1.24				0.0
332	333	May			053628		.80	1.18				0.0
333	334	May			028639		.79	1.28				0.0
334	335	May			180713		.77	1.19				0.0
335	336	Jun			346057		.74	1.15				0.0
336	337	Jun			223429		.76	1.23				0.0
337	338	Jun			076794		.76	1.22				0.0
338	339	Jun			869966		.82	1.28				0.0
339	340	Jul			790525		.83	1.26				0.0
340	341	Jul			035924		.81	1.41				0.0
341	342	Jul			884044		.81	1.20				0.0
342	343	Jul			308044		.72	1.45				0.0
343	344	Aug			038505		.81	1.38				0.0
344	345	Aug			979502		.84	1.19				0.0
345	346	Aug			241296		.79	1.31				0.0
346	347	Aug			392656		.77	1.47				0.0
347	348	Aug			971806		.87	1.46				0.0
348	349	Sep			201017		.86	1.23				0.0
349	350	Sep			187952		.86	1.34				0.0
350	351	Sep			323594		.81	1.42				0.0
351	352				482849		.77	1.42				0.0
352		Sep Oct			543017		.79	1.34				0.0
353	353 354	Oct					.79	1.42				0.0
354	355				479046 286465		.79	1.31				
354	333	Oct		2	200403	U	.01	1.31				0.0
	LNWE	עםי	Ton	Feb	Mar			00	.+	Nov	\	
0	0.0000		Jan 1	0	мат 0	•	• •	UC	0	0	\	
1	0.6931		1	0	0	•	• •		0	0		
				0		•	• •		0			
2	1.0986		1		0	•	• •			0		
3	1.3862		1	0	0	•	• •		0	0		
4	1.6094		0	1	0	•	• •		0	0		
5 6	1.7917		0	1	0	•	• •		0	0		
6	1.9459		0	1	0	•	• •		0	0		
7	2.0794		0	1	0	•	• •		0	0		
8	2.19/2	2.197225 0		0	1				0	0		

9	2.302585	0	0	1		0	0
10	2.397895	0	0	1		0	0
11	2.484907	0	0	1		0	0
12	2.564949	0	0	1		0	0
13	2.639057	0	0	0	• • •	0	0
14	2.708050	0	0	0	• • •	0	0
15	2.772589	0	0	0	• • •	0	0
16	2.833213	0	0	0	• • •	0	0
17	2.890372	0	0	0	• • •	0	0
18	2.944439	0	0	0		0	0
19	2.995732	0	0	0		0	0
20	3.044522	0	0	0		0	0
21	3.091042	0	0	0		0	0
22	3.135494	0	0	0		0	0
23	3.178054	0	0	0		0	0
24	3.218876	0	0	0		0	0
25	3.258097	0	0	0		0	0
26	3.295837	0	0	0	•••	0	0
27	3.332205	0	0	0	•••	0	0
28	3.367296	0	0	0	•••	0	0
29	3.401197	0	0	0	•••	0	0
	3.401137	O	U	U	•••	U	O
 325	5.786897	0	0	1	•••	0	0
326	5.789960	0	0		•••	0	
327	5.793014		0	0	•••	0	0
		0			• • •		0
328	5.796058	0	0	0	• • •	0	0
329	5.799093	0	0	0	• • •	0	0
330	5.802118	0	0	0	• • •	0	0
331	5.805135	0	0	0	• • •	0	0
332	5.808142	0	0	0	• • •	0	0
333	5.811141	0	0	0	• • •	0	0
334	5.814131	0	0	0	• • •	0	0
335	5.817111	0	0	0	• • •	0	0
336	5.820083	0	0	0	• • •	0	0
337	5.823046	0	0	0	• • •	0	0
338	5.826000	0	0	0	• • •	0	0
339	5.828946	0	0	0	• • •	0	0
340	5.831882	0	0	0	• • •	0	0
341	5.834811	0	0	0	• • •	0	0
342	5.837730	0	0	0	• • •	0	0
343	5.840642	0	0	0	• • •	0	0
344	5.843544	0	0	0		0	0
345	5.846439	0	0	0		0	0
346	5.849325	0	0	0		0	0
347	5.852202	0	0	0	• • •	0	0
348	5.855072	0	0	0	• • •	0	0
349	5.857933	0	0	0	• • •	0	0
350	5.860786	0	0	0		0	0

```
0
                                                                     0
351
    5.863631
                  0
                       0
                             0
352
    5.866468
                  0
                       0
                             0
                                                                1
                                                                     0
     5.869297
                       0
                                                                     0
353
                  0
                             0
                                                                1
                       0
                                                                     0
    5.872118
                  0
                             0
                                                                1
354
                                            . . .
     Monthly Dummy Effects
                              PREDICTED YOPLAIT UNITS
                                                               95PI L
0
              416788.905078
                                          1.353762e+06
                                                         1.018292e+06
1
              416788.905078
                                          1.282463e+06
                                                         9.469929e+05
2
              416788.905078
                                          1.223484e+06
                                                         8.880141e+05
3
              416788.905078
                                          1.318253e+06
                                                         9.827834e+05
4
              457736.148745
                                          1.437371e+06
                                                         1.101901e+06
5
              457736.148745
                                          1.190714e+06
                                                         8.552444e+05
6
              457736.148745
                                          1.223827e+06
                                                         8.883572e+05
7
              457736.148745
                                          1.163529e+06
                                                         8.280593e+05
8
              476321.069384
                                          1.376947e+06
                                                         1.041477e+06
9
              476321.069384
                                          1.479659e+06
                                                         1.144189e+06
10
              476321.069384
                                          1.307870e+06
                                                         9.724003e+05
                                                         8.267052e+05
              476321.069384
11
                                          1.162175e+06
12
              476321.069384
                                          1.348654e+06
                                                         1.013184e+06
              426062.711488
                                          1.432007e+06
                                                         1.096537e+06
13
14
              426062.711488
                                          1.233962e+06
                                                         8.984920e+05
              426062.711488
                                          1.319776e+06
                                                         9.843062e+05
15
16
              426062.711488
                                          1.025412e+06
                                                         6.899423e+05
17
              420077.724684
                                          1.300532e+06
                                                         9.650618e+05
              420077.724684
                                          1.000301e+06
                                                         6.648313e+05
18
              420077.724684
                                          1.345669e+06
                                                         1.010199e+06
19
              420077.724684
20
                                          1.150087e+06
                                                         8.146169e+05
21
              420077.724684
                                          1.411789e+06
                                                         1.076319e+06
22
              363990.520966
                                          1.441580e+06
                                                         1.106110e+06
23
              363990.520966
                                          1.457945e+06
                                                         1.122475e+06
24
              363990.520966
                                          1.329518e+06
                                                         9.940485e+05
25
              363990.520966
                                          1.168247e+06
                                                         8.327772e+05
26
              343386.604344
                                          1.286010e+06
                                                         9.505403e+05
27
              343386.604344
                                          1.108979e+06
                                                         7.735092e+05
                                          1.336291e+06
                                                         1.000821e+06
28
              343386.604344
29
              343386.604344
                                          1.303390e+06
                                                         9.679198e+05
              476321.069384
                                          2.074048e+06
                                                         1.738578e+06
325
326
              426062.711488
                                          1.995707e+06
                                                         1.660238e+06
327
              426062.711488
                                          1.942643e+06
                                                         1.607173e+06
              426062.711488
328
                                          2.328325e+06
                                                         1.992855e+06
329
              426062.711488
                                          2.067971e+06
                                                         1.732501e+06
              420077.724684
330
                                          2.237155e+06
                                                         1.901685e+06
331
              420077.724684
                                          2.415547e+06
                                                         2.080077e+06
332
              420077.724684
                                          2.109702e+06
                                                         1.774232e+06
333
              420077.724684
                                          2.161301e+06
                                                         1.825831e+06
334
              420077.724684
                                          2.240657e+06
                                                         1.905187e+06
335
              363990.520966
                                         2.311022e+06
                                                        1.975552e+06
```

```
336
                                          2.231798e+06
              363990.520966
                                                         1.896328e+06
337
              363990.520966
                                          2.231458e+06
                                                         1.895988e+06
338
                                          1.978344e+06
                                                         1.642874e+06
              363990.520966
              343386.604344
                                          1.913523e+06
                                                         1.578053e+06
339
340
              343386.604344
                                          2.012211e+06
                                                         1.676741e+06
341
              343386.604344
                                          1.995748e+06
                                                         1.660279e+06
342
              343386.604344
                                          2.403975e+06
                                                         2.068505e+06
343
              406551.827621
                                          2.074336e+06
                                                         1.738866e+06
344
              406551.827621
                                          1.930275e+06
                                                         1.594805e+06
345
              406551.827621
                                          2.155745e+06
                                                         1.820275e+06
              406551.827621
346
                                          2.255230e+06
                                                         1.919761e+06
347
              406551.827621
                                          1.824187e+06
                                                         1.488718e+06
              453551.117530
348
                                          1.896173e+06
                                                         1.560703e+06
349
              453551.117530
                                          1.905487e+06
                                                         1.570017e+06
350
              453551.117530
                                          2.127728e+06
                                                         1.792258e+06
351
              453551.117530
                                          2.298839e+06
                                                         1.963370e+06
352
              349466.722548
                                          2.104228e+06
                                                         1.768758e+06
              349466.722548
353
                                          2.111120e+06
                                                         1.775650e+06
354
              349466.722548
                                          2.016561e+06
                                                         1.681092e+06
           95PI U
                        MAPE
                               Own_elasticity
                                                Cross_elasticity($Dannon)
0
     1.689232e+06
                    0.054497
                                    -2.417886
                                                                   0.061907
1
     1.617933e+06
                    0.172339
                                    -2.686642
                                                                  0.059066
2
     1.558954e+06
                    0.155429
                                    -2.921759
                                                                  0.067182
3
                                    -2.679043
     1.653723e+06
                    0.057051
                                                                  0.067243
4
     1.772841e+06
                    0.058017
                                    -2.427062
                                                                  0.061670
5
     1.526184e+06
                    0.095027
                                    -3.146852
                                                                  0.060233
6
     1.559297e+06
                    0.019325
                                    -3.061708
                                                                  0.065846
7
     1.498999e+06
                    0.035267
                                    -3.294408
                                                                  0.073414
8
     1.712417e+06
                    0.106925
                                    -2.658682
                                                                  0.064962
9
     1.815128e+06
                    0.009363
                                    -2.415912
                                                                  0.060452
10
     1.643340e+06
                    0.035206
                                    -2.864964
                                                                  0.057302
11
     1.497645e+06
                    0.112325
                                    -3.372364
                                                                  0.075580
12
     1.684123e+06
                    0.015895
                                    -2.778327
                                                                  0.066324
13
     1.767477e+06
                    0.044647
                                    -2.526380
                                                                  0.057399
14
     1.569432e+06
                    0.065928
                                    -3.106368
                                                                  0.071836
15
     1.655246e+06
                    0.096451
                                    -2.839119
                                                                  0.059227
16
     1.360882e+06
                    0.170780
                                    -3.948153
                                                                  0.073872
17
     1.636001e+06
                    0.129235
                                    -2.914247
                                                                  0.068779
                    0.207803
                                    -4.090322
18
     1.335771e+06
                                                                  0.082171
19
                                    -2.784490
     1.681139e+06
                    0.014702
                                                                  0.055692
20
     1.485557e+06
                    0.104254
                                    -3.445259
                                                                  0.075674
21
     1.747259e+06
                    0.028150
                                    -2.623573
                                                                  0.058792
22
     1.777050e+06
                    0.070013
                                    -2.509604
                                                                  0.052546
23
     1.793415e+06
                    0.032629
                                    -2.481435
                                                                  0.058589
24
     1.664988e+06
                    0.040832
                                    -2.818315
                                                                  0.060006
25
     1.503717e+06
                    0.008360
                                    -3.354836
                                                                  0.072428
26
     1.621480e+06
                                    -2.947154
                    0.021083
                                                                  0.068302
```

27	1.444449e+06	0.056291	-3.572968	0.069759
28	1.671761e+06	0.019560	-2.804032	0.062717
29	1.638859e+06	0.030797	-2.907857	0.068009
			•••	
325	2.409518e+06	0.031379	-1.702785	0.044682
326	2.331177e+06	0.036910	-1.791207	0.053704
327	2.278113e+06	0.044270	-1.862306	0.049778
328	2.663795e+06	0.008543	-1.387338	0.040494
329	2.403441e+06	0.008190	-1.686962	0.044423
330	2.572625e+06	0.000190	-1.482379	0.042144
	2.751016e+06			
331		0.068891	-1.301584	0.041367
332	2.445172e+06	0.027305	-1.633178	0.045073
333	2.496771e+06	0.065395	-1.574260	0.047725
334	2.576126e+06	0.027488	-1.480062	0.042798
335	2.646492e+06	0.014934	-1.379089	0.040100
336	2.567268e+06	0.003764	-1.466639	0.044412
337	2.566928e+06	0.074473	-1.466863	0.044058
338	2.313814e+06	0.057957	-1.785158	0.052139
339	2.248993e+06	0.068694	-1.868138	0.053063
340	2.347680e+06	0.011648	-1.733709	0.056467
341	2.331218e+06	0.059290	-1.748010	0.048454
342	2.739444e+06	0.041564	-1.289933	0.048606
343	2.409806e+06	0.017577	-1.681785	0.053611
344	2.265745e+06	0.024869	-1.874238	0.049680
345	2.491215e+06	0.038170	-1.578317	0.048969
346	2.590700e+06	0.057436	-1.470498	0.052526
347	2.159657e+06	0.074865	-2.054066	0.064496
348	2.231643e+06	0.138502	-1.953373	0.052273
349	2.240957e+06	0.129100	-1.943824	0.056670
350	2.463197e+06	0.084295	-1.639584	0.053780
351	2.634309e+06	0.074112	-1.442603	0.049076
352	2.439698e+06	0.172547	-1.616958	0.051317
353	2.446590e+06	0.148414	-1.611680	0.054203
354	2.352031e+06	0.118044	-1.729968	0.052349
304	2.332031e+00	0.110044	-1.729900	0.002049
	Cross_elastic	i+v(¢Choho	ani)	
0	CIOSS_elastic	•	0.0	
0				
1			0.0	
2			0.0	
3			0.0	
4			0.0	
5			0.0	
6			0.0	
7			0.0	
8			0.0	
9			0.0	
10			0.0	
11			0.0	

12	0.0
13	0.0
14	0.0
15	0.0
16	0.0
17	0.0
18	0.0
19	0.0
20	0.0
21	0.0
22	0.0
23	0.0
24	0.0
25	0.0
26	0.0
27	
	0.0
28	0.0
29	0.0
••	
325	0.0
326	0.0
327	0.0
328	0.0
329	0.0
330	0.0
331	0.0
332	0.0
333	0.0
334	0.0
335	0.0
336	0.0
337	0.0
338	0.0
339	0.0
340	0.0
341	0.0
342	0.0
343	0.0
344	0.0
345	0.0
346	0.0
347	0.0
348	0.0
349	0.0
350	0.0
351	0.0
352	0.0
353	0.0

354 0.0

[355 rows x 26 columns]

In [19]: C1["Own_elasticity"].mean()

Out[19]: -2.2836216791501704

In [20]: C1["Cross_elasticity(\$Dannon)"].mean()

Out[20]: 0.05614998038497148

In [21]: C2= newdf.iloc[355:,:]

C2

Out[21]:		WEEK	MONTH	YOPLAIT_UNITS	YOPLAIT_PRICE	DANNON_PRICE	CHOBANI_PRICE	\
	355	356	Oct	2043922	0.84	1.39	1.59	
	356	357	Nov	2124336	0.83	1.34	1.81	
	357	358	Nov	1920303	0.87	1.38	1.87	
	358	359	Nov	1792904	0.90	1.37	1.77	
	359	360	Nov	1504751	0.90	1.49	1.91	
	360	361	Nov	2170956	0.81	1.36	1.77	
	361	362	Dec	1882789	0.88	1.40	1.60	
	362	363	Dec	2031723	0.83	1.43	1.66	
	363	364	Dec	1497527	0.88	1.50	1.73	
	364	365	Dec	1329942	0.87	1.51	1.71	
	365	366	Jan	2885652	0.68	1.25	1.71	
	366	367	Jan	3297557	0.67	1.04	1.78	
	367	368	Jan	2682321	0.80	1.19	1.79	
	368	369	Jan	2214002	0.85	1.33	1.78	
	369	370	Jan	2463497	0.82	1.37	1.78	
	370	371	Feb	2530724	0.84	1.25	1.37	
	371	372	Feb	2584175	0.81	1.40	1.70	
	372	373	Feb	2437308	0.84	1.32	1.70	
	373	374	Feb	2603196	0.83	1.45	1.64	
	374	375	Mar	2402458	0.89	1.24	1.67	
	375	376	Mar	2927317	0.74	1.42	1.19	
	376	377	Mar	2465764	0.83	1.49	1.59	
	377	378	Mar	2094173	0.88	1.54	1.22	
	378	379	Apr	2309544	0.90	1.38	1.76	
	379	380	Apr	2230684	0.91	1.18	1.69	
	380	381	Apr	2473041	0.86	1.57	1.69	
	381	382	Apr	2841959	0.80	1.46	1.74	
	382	383	May	2788426	0.80	1.49	1.49	
	383	384	May	2571108	0.84	1.40	1.64	
	384	385	May	2548138	0.82	1.44	1.71	
	543	544	Jun	1903941	0.85	1.56	1.40	
	544	545	Jun	1654621	0.97	1.54	1.39	

545	546	Jur	1	1	737019	0.9	93 1	.42		1	.40
546	547	Jur	ı		759658	0.9		.66			.40
547	548	Jur			746264	0.9		.63			.41
548	549	Jul			615631	0.9		.54		1	.41
549	550	Jul			851221	0.9		.60			.40
550	551	Ju]			898320	0.8		.61			.41
551	552	Ju]			509453	0.9		.50			.39
552	553	Aug			879026	0.9		.65			.28
553	554	Aug			025709	0.9		.58			.37
554	555	Aug			867477	0.9		.65			.38
555	556	_	-		594002	1.0		.65			.23
556	557	Aug			613750	1.0		.63			.37
		Ser									
557	558	Ser			032965	0.9		.61			.33
558	559	Ser			745274	1.0		.64			.41
559	560	Sep			679836	1.0		.67			.36
560	561	Ser			792941	0.9		.71			.36
561	562	Oct			890071	0.9		.64			.29
562	563	0ct			854960	0.9		.73			.24
563	564	0ct			681291	1.0		.68			.32
564	565	Oct			570368	0.9		.78			.31
565	566	roN			570216	1.0		.76			.21
566	567	roN			737014	0.9		.86			.30
567	568	roN			428985	1.0		.75			.31
568	569	roN	I		076198	1.		.77			.38
569	570	Dec	2	1	523707	1.0	00 1	.83			.31
570	571	Dec		1	579472	1.0	00 1	.88		1	.28
571	572	Dec	3	1	223610	1.0	07 1	.85		1	.25
572	573	Dec		1	092610	1.0	04 1	.90		1	.40
	LNWE	EEK	Jan	Feb	Mar			Oct	Nov	\	
355	5.8749	931	0	0	0		•	1	0		
356	5.8777	736	0	0	0			0	1		
357	5.8805	533	0	0	0		•	0	1		
358	5.8833	322	0	0	0			0	1		
359	5.8861	L04	0	0	0		•	0	1		
360	5.8888	378	0	0	0			0	1		
361	5.8916		0	0	0			0	0		
362	5.8944		0	0	0			0	0		
363	5.8971		0	0	0			0	0		
364	5.8998		0	0	0		_	0	0		
365	5.9026		1	0	0		_	0	0		
366	5.9053		1	0	0		•	0	0		
367	5.9080		1	0	0	• •	•	0	0		
368	5.9107		1	0	0	• •	-	0	0		
369	5.9135		1	0	0	• •	-	0	0		
370	5.9162		0	1	0	• •	-	0	0		
371	5.9188		0	1	0	• •	-	0	0		
372	5.9215		0	1	0	• •	-	0	0		
012	0.0210	,, 0	U	_	U	• •	•	U	U		

373	5.924256	5 0	1	0		0	0
					• • •		
374	5.926926		0	1	• • •	0	0
375	5.929589		0	1	• • •	0	0
376	5.932245		0	1		0	0
377	5.934894		0	1	• • •	0	0
378	5.937536	0	0	0		0	0
379	5.940171	L 0	0	0		0	0
380	5.942799	9 0	0	0		0	0
381	5.945421	L 0	0	0		0	0
382	5.948035	5 0	0	0		0	0
383	5.950643	3 0	0	0		0	0
384	5.953243	3 0	0	0		0	0
	0.000210						· ·
 543	6.298949	9 0	0	0	• • •	0	0
544	6.300786		0	0	• • •	0	0
545	6.302619		0		• • •	0	0
				0	• • •		
546	6.304449		0	0	• • •	0	0
547	6.306275		0	0	• • •	0	0
548	6.308098		0	0	• • •	0	0
549	6.309918		0	0	• • •	0	0
550	6.311735	5 0	0	0		0	0
551	6.313548	3 0	0	0		0	0
552	6.315358	3 0	0	0		0	0
553	6.317165	5 0	0	0		0	0
554	6.318968	3 0	0	0		0	0
555	6.320768	3 0	0	0		0	0
556	6.322565		0	0		0	0
557	6.324359		0	0		0	0
558	6.326149		0	0		0	0
559	6.327937		0	0	• • • •	0	0
560	6.329721		0	0	• • •	0	0
561	6.331502		0	0	• • •	1	0
562	6.333280		0	0	• • •	1	0
					• • •		
563	6.335054		0	0	• • •	1	0
564	6.336826		0	0	• • •	1	0
565	6.338594		0	0	• • •	0	1
566	6.340359		0	0		0	1
567	6.342121		0	0	• • •	0	1
568	6.343880		0	0	• • •	0	1
569	6.345636	5 0	0	0		0	0
570	6.347389	9 0	0	0		0	0
571	6.349139	0	0	0		0	0
572	6.350886	5 0	0	0		0	0
	Monthly	Dummv 1	Effects	PREDICTED	YOPLAIT UNITS	95PI_	L \
355	J	•	.722548		2.301102e+06	1.965632e+0	
356			.340772		2.186453e+06	1.850983e+0	
357			. 340772 . 340772		2.033194e+06	1.697724e+0	
551		100042	. 0 10 1 1 2		2.0001346.00	1.001124610	, ,

250	120040 240770	1 070001 - 100	1 540561-106
358	139042.340772		1.542561e+06
359	139042.340772		1.588493e+06
360	139042.340772		1.930250e+06
361	0.000000		1.449883e+06
362	0.000000		1.683433e+06
363	0.000000		1.492073e+06
364	0.000000		1.531262e+06
365	416788.905078	3.081310e+06	2.745840e+06
366	416788.905078	3.125797e+06	2.790327e+06
367	416788.905078	2.580975e+06	2.245505e+06
368	416788.905078	2.374780e+06	2.039310e+06
369	416788.905078	2.507636e+06	2.172166e+06
370	457736.148745	2.348287e+06	2.012817e+06
371	457736.148745	2.574447e+06	2.238977e+06
372	457736.148745	2.439215e+06	2.103746e+06
373	457736.148745	2.477828e+06	2.142359e+06
374	476321.069384	2.229173e+06	1.893704e+06
375	476321.069384	2.767307e+06	2.431837e+06
376	476321.069384	2.488099e+06	2.152629e+06
377	476321.069384	2.182523e+06	1.847053e+06
378	426062.711488	2.171827e+06	1.836357e+06
379	426062.711488	2.095143e+06	1.759673e+06
380	426062.711488	2.342329e+06	2.006860e+06
381	426062.711488	2.605086e+06	2.269616e+06
382	420077.724684	2.537958e+06	2.202488e+06
383	420077.724684	2.397223e+06	2.061753e+06
384	420077.724684	2.504905e+06	2.169435e+06
543	363990.520966	2.304337e+06	1.968868e+06
544	363990.520966		1.448158e+06
545	363990.520966	1.949081e+06	1.613611e+06
546	363990.520966		1.719377e+06
547	363990.520966		1.719806e+06
548	343386.604344		1.347684e+06
549	343386.604344		1.608661e+06
550	343386.604344		1.784587e+06
551	343386.604344		1.340200e+06
552	406551.827621		1.559867e+06
553	406551.827621		1.491402e+06
554	406551.827621		1.586023e+06
555	406551.827621		1.203372e+06
556	453551.117530		1.327935e+06
557	453551.117530		1.617853e+06
558	453551.117530		1.167264e+06
559	453551.117530		1.286375e+06
560	453551.117530		1.462155e+06
561	349466.722548		1.420936e+06
562	349466.722548	1.665006e+06	1.329536e+06

```
563
              349466.722548
                                         1.638658e+06
                                                        1.303188e+06
564
              349466.722548
                                         1.687505e+06
                                                        1.352035e+06
              139042.340772
                                                        1.071620e+06
565
                                         1.407089e+06
              139042.340772
                                         1.567662e+06
                                                        1.232192e+06
566
567
              139042.340772
                                         1.174013e+06
                                                        8.385433e+05
568
              139042.340772
                                         1.021538e+06
                                                        6.860678e+05
569
                   0.000000
                                         1.300384e+06
                                                        9.649145e+05
570
                   0.000000
                                         1.297013e+06
                                                        9.615429e+05
571
                   0.000000
                                         9.857110e+05
                                                        6.502412e+05
572
                   0.000000
                                         1.157605e+06
                                                        8.221350e+05
           95PI U
                        MAPE
                              Own_elasticity
                                                Cross_elasticity($Dannon)
                                                                  0.048678
355
    2.636571e+06
                    0.125827
                                    -1.572201
356
     2.521923e+06
                    0.029241
                                    -1.634943
                                                                  0.049387
357
     2.368664e+06
                    0.058788
                                    -1.842914
                                                                  0.054695
358
     2.213501e+06
                    0.047480
                                    -2.063975
                                                                  0.058785
359
     2.259433e+06
                    0.278592
                                    -2.014700
                                                                  0.062408
360
     2.601190e+06
                    0.043651
                                    -1.539726
                                                                  0.048371
361
     2.120823e+06
                    0.051751
                                    -2.122869
                                                                  0.063191
     2.354372e+06
362
                    0.006310
                                    -1.770628
                                                                 0.057078
363
    2.163013e+06
                    0.220374
                                    -2.073861
                                                                  0.066142
364
     2.202202e+06
                    0.403619
                                    -2.007252
                                                                  0.065185
365
    3.416780e+06
                    0.067804
                                    -0.950469
                                                                 0.032691
366
     3.461267e+06
                    0.052087
                                    -0.923163
                                                                 0.026812
367
     2.916445e+06
                    0.037783
                                    -1.334968
                                                                 0.037155
368
     2.710250e+06
                    0.072619
                                    -1.541559
                                                                  0.045131
369
     2.843106e+06
                    0.017917
                                    -1.408361
                                                                  0.044026
370
    2.683756e+06
                    0.072089
                                    -1.540610
                                                                  0.042895
371
     2.909917e+06
                    0.003765
                                    -1.355082
                                                                  0.043822
372
     2.774685e+06
                    0.000783
                                    -1.483180
                                                                  0.043609
373
     2.813298e+06
                    0.048159
                                    -1.442685
                                                                 0.047157
                                    -1.719534
374
                                                                  0.044826
     2.564643e+06
                    0.072128
375
     3.102777e+06
                    0.054661
                                    -1.151699
                                                                  0.041351
376
     2.823569e+06
                    0.009058
                                    -1.436729
                                                                 0.048258
377
     2.517992e+06
                    0.042188
                                    -1.736555
                                                                 0.056861
378
     2.507296e+06
                    0.059630
                                    -1.784769
                                                                 0.051204
379
     2.430613e+06
                    0.060762
                                    -1.870649
                                                                 0.045386
     2.677799e+06
                                                                 0.054014
380
                    0.052855
                                    -1.581303
381
     2.940555e+06
                    0.083349
                                    -1.322612
                                                                 0.045163
382
     2.873428e+06
                    0.089824
                                    -1.357595
                                                                 0.047310
    2.732692e+06
383
                    0.067631
                                    -1.509161
                                                                  0.047062
384
    2.840375e+06
                    0.016967
                                    -1.409896
                                                                  0.046326
. .
               . . .
                         . . .
                                          . . .
543
    2.639807e+06
                    0.210299
                                    -1.588684
                                                                  0.054554
     2.119098e+06
                    0.077968
                                    -2.342244
                                                                  0.069577
544
545
     2.284551e+06
                    0.122084
                                    -2.055028
                                                                 0.058710
546
     2.390317e+06
                    0.167754
                                    -1.907333
                                                                  0.065100
    2.390746e+06
                                    -1.906935
547
                   0.176956
                                                                  0.063910
```

548	2.018624e+06	0.041794	-2.533237	0.073731
549	2.279600e+06	0.050188	-2.060261	0.066320
550	2.455527e+06	0.116807	-1.808036	0.061197
551	2.011140e+06	0.110118	-2.544551	0.072136
552	2.230806e+06	0.008680	-2.158748	0.070153
553	2.162341e+06	0.098157	-2.286801	0.069695
554	2.256963e+06	0.028925	-2.129362	0.069198
555	1.874311e+06	0.034605	-2.882757	0.086405
556	1.998874e+06	0.030770	-2.640991	0.078966
557	2.288792e+06	0.039176	-2.094663	0.066421
558	1.838204e+06	0.138970	-3.038005	0.087945
559	1.957315e+06	0.034522	-2.735221	0.082977
560	2.133095e+06	0.002612	-2.371924	0.076656
561	2.091876e+06	0.070720	-2.378545	0.075244
562	2.000476e+06	0.102403	-2.560849	0.083730
563	1.974127e+06	0.025357	-2.628309	0.082617
564	2.022975e+06	0.074592	-2.526706	0.085001
565	1.742559e+06	0.103888	-3.060856	0.100796
566	1.903132e+06	0.097496	-2.664918	0.095612
567	1.509483e+06	0.178429	-3.888638	0.120120
568	1.357007e+06	0.050790	-4.637703	0.139627
569	1.635854e+06	0.146565	-3.312019	0.113404
570	1.632483e+06	0.178831	-3.320629	0.116806
571	1.321181e+06	0.194424	-4.675185	0.151242
572	1.493075e+06	0.059486	-3.869347	0.132265

${\tt Cross_elasticity(\$Chobani)}$

355	0.176810
356	0.211828
357	0.235347
358	0.241166
359	0.254028
360	0.199900
361	0.229320
362	0.210396
363	0.242228
364	0.234401
365	0.142006
366	0.145715
367	0.177466
368	0.191797
369	0.181636
370	0.149285
371	0.168970
372	0.178338
373	0.169363
374	0.191698
375	0.110036

```
376
                                  0.163522
         377
                                  0.143036
                                  0.207364
         378
         379
                                  0.206404
                                  0.184622
         380
         381
                                  0.170912
         382
                                  0.150227
         383
                                  0.175058
         384
                                  0.174683
         543
                                  0.155463
         544
                                  0.199414
         545
                                  0.183799
                                  0.174339
         546
         547
                                  0.175548
         548
                                  0.214359
         549
                                  0.184267
                                  0.170183
         550
         551
                                  0.212262
         552
                                  0.172810
         553
                                  0.191893
                                  0.183775
         554
         555
                                  0.204530
         556
                                  0.210750
         557
                                  0.174230
                                  0.240095
         558
         559
                                  0.214573
                                  0.193591
         560
         561
                                  0.187936
         562
                                  0.190569
         563
                                  0.206125
                                  0.198642
         564
         565
                                  0.220044
         566
                                  0.212196
                                  0.285525
         567
         568
                                  0.345677
                                  0.257778
         569
         570
                                  0.252529
         571
                                  0.324494
         572
                                  0.309466
         [218 rows x 26 columns]
In [22]: C2["Own_elasticity"].mean()
Out[22]: -1.7857630542663008
In [23]: C2["Cross_elasticity($Dannon)"].mean()
```

```
Out [23]: 0.05453197144187152
In [24]: C2["Cross_elasticity($Chobani)"].mean()
Out [24]: 0.16950989547367418
In [25]: D1=pd.DataFrame({'Before Chobani entry: % in unit sales of YOPLAIT': [-2.284,0.056,"N/.
                                                                                                              'After Chobani entry: % in unit sales of YOPLAIT':[-1.786,0.055,0.1
                                                                                                              'Price change':["1%_change_$YOPLAIT", "1%_change_$DANNON", "1%_change_$DANNON", "1%_change_$DANNON", "1%_change_$TANNON", "1%_change_$T
                                                                                                              index=[1,2,3])
                                    D1=D1.set_index('Price change')
Out [25]:
                                                                                                                Before Chobani entry: % in unit sales of YOPLAIT \
                                    Price change
                                    1%_change_$YOPLAIT
                                                                                                                                                                                                                                                                                                -2.284
                                    1%_change_$DANNON
                                                                                                                                                                                                                                                                                                    0.056
                                    1%_change_$CHOBANI
                                                                                                                                                                                                                                                                                                            N/A
                                                                                                                     After Chobani entry: % in unit sales of YOPLAIT
                                    Price change
                                    1%_change_$YOPLAIT
                                                                                                                                                                                                                                                                                                -1.786
                                    1%_change_$DANNON
                                                                                                                                                                                                                                                                                                    0.055
                                    1%_change_$CHOBANI
                                                                                                                                                                                                                                                                                                    0.170
```

- Then to illustrate the effect of Chobani's entry, the price elasticities are calculated to see whether the Chobani's entry will affect the elasticities. Three price-related elasticities can be calculated using the formulas: Own_elasticity = b1 * Yoplait Price/ predict sales Cross_elasticity(Dannon) = b2 * Dannon Price/ predict sales Cross_elasticity(Dannon) = b3 * Chobani Price/ predict sales *The predict sales are obtained by taking independent variables into the estimated linear regression function.
- To compare the elasticities change after Chobani's entry, we firstly take the average of the weekly price elasticity between week 1 and week 355 for "Before Chobani entry", and take the average of the weekly price elasticity between week 356 and 753 for "After Chobani entry".

Comparing the change in elasticities, it can be observed that:

- 1.There is a decrease in Yoplait own-price elasticity after Chobani's entry, which means customers became less sensitive to Yoplait price.
- 2.On the other hand, the cross-price elasticity with respect to Dannon's price remained the same after Chobani's entry. It suggests that Chobani's entry did not significantly affect the substitutability of Yoplait for Dannon.
- 3.The comparison between the two cross-price elasticities values (Dannon v/s Chobani) indicates that Yoplait serves as a better substitute for Chobani than for Dannon (0.170 v/s 0.055).
- 4.The decrease of own-price elasticity of Yoplait price can be explained based on our previous interpretation: among the original Yoplait consumers, some consumers switched to

Chobani after its entry. This is likely because Yoplait and Chobani are better substitutes. Now, the remaining consumers are relatively more loyal Yoplait consumers (that's why they didn't switch). This could be the reasoning behind why the Yoplait demand is less elastic than it was before Chobani's entry.

• 5.Since remaining Yoplait consumers post-Chobani are more loyal than those pre-Chobani, it is likely that we can charge a higher price for Yoplait post-Chobani than that pre-Chobani. This might lead to margin improvement even though Yoplait lost some consumers to Chobani.

In []: