Team Project 2
Pricing Analytics (MKT 440/31)
by Prof. Takeaki Sunada

Submitted by
Qianyu Dong (Qianyu.Dong@simon.rochester.com)
Yaqing Sun (Yaqing.Sun@simon.rochester.com)
Yilan Zhang (Yilan.Zhang@simon.rochester.com)

Feb. 12, 2020

3 Logit model without segmentation

3.1 Own-elasticiy and cross-elasticity (without segmentation)

Product	Own-elasticity
KB	-4.26
KR	-4.13
MB	-4.07

Products	Cross-elasticity
KB ← KR	1.02
KR ← KB	0.91
KB ← MB	0.96
MB ← KB	0.91
KR ← MB	0.96
MB ← KR	1.02

From the elasticities above, we can see two patterns:

(1) KB has the largest own-price elasticity (absolute value) among the three products, which means consumers are most price sensitive to KB. This pattern is reasonable. Compared with KR and MB, KB is new to the market thus may not be well-received by consumers. Once the price of KB increases a little bit, the probability people choose it will experience a relatively large drop.

(2) According to the cross-price elasticities, once the price of KR increases by one percent, the probability people choose KB will increase by 1.02%. This cross-price elasticity is relatively high compared with other combinations, which means KR and KB are closer substitutes. We are concerned about this pattern because if we are to launch this new product KB, we want to position it on different consumers from KR to avoid cannibalization.

3.2 Optimal prices for KB and KR (without segmentation)

The optimal prices are $1.16 for KB and $1.16 for KR when the price of MB is $1.43 and the maximum profit is $393.4082.

4 Logit model with segmentation

We group consumers into 8 segments. Reasons are as follows.

(1) We tried different numbers of segments and did scatter plots based on beta1, beta0(KB)-beta0(KR) and beta0(KB)-beta0(MB) of each segment. In the scatter plots of 8 segments (shown in 4.2), there is no overlap among the segments which means each segment has distinguishing preferences for products and price sensitivity which will lead to more accurate profit estimation and better positioning.

(2) We calculated maximum profit under different segmentation and found that Kiwi can gain highest profit using 8 segments. Here are some maximum profits under different segmentation. Notice that with better segmentation, the maximum profit of Kiwi can increase 0.8%.

no seg	4	5	6	7	**8**	9
$393.41	$396.3	$393.78	$392.66	$394.85	**$396.59**	$395.39

(3) Although some segmentations with number of segments larger than 10 also perform well in scatter plot and profit, considering that small number of individuals within each segment may cause bias in coefficients estimation, we think 8 is the most appropriate number of segments with proper number of individuals within each segment and balanced segment shares.

```
> demo_cluster
K-means clustering with 7 clusters of sizes 53, 38, 41, 47, 31, 39, 34

> seg.share
         1          2          3          4          5          6          7
0.14763231 0.10584958 0.11420613 0.13091922 0.08635097 0.10863510 0.09470752 0.21169916
```

4.1 Own-elasticiy and cross-elasticity with segmentation

Product	Own-elasticity
KB	-4.36
KR	-3.82
MB	-4.19

Products	Cross-elasticity
KB ← KR	0.95
KR ← KB	0.86
KB ← MB	1.05
MB ← KB	1.00
KR ← MB	0.87
MB ← KR	0.92

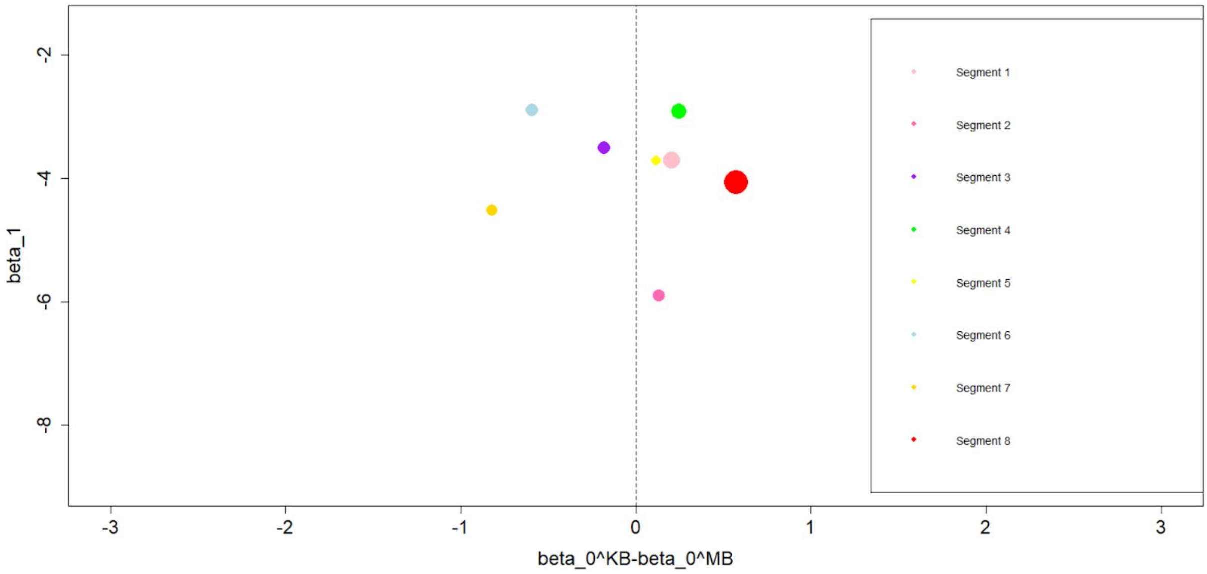
We can see from the cross-elasticity table that KB & MB are the closer substitutes, because of the relatively high cross-elasticities(1.05, 1.00); Both KB & KR and KR & MB are not as close substitutes, because of the relatively low cross-elasticities(0.94, 0.85), (0.87, 0.92).

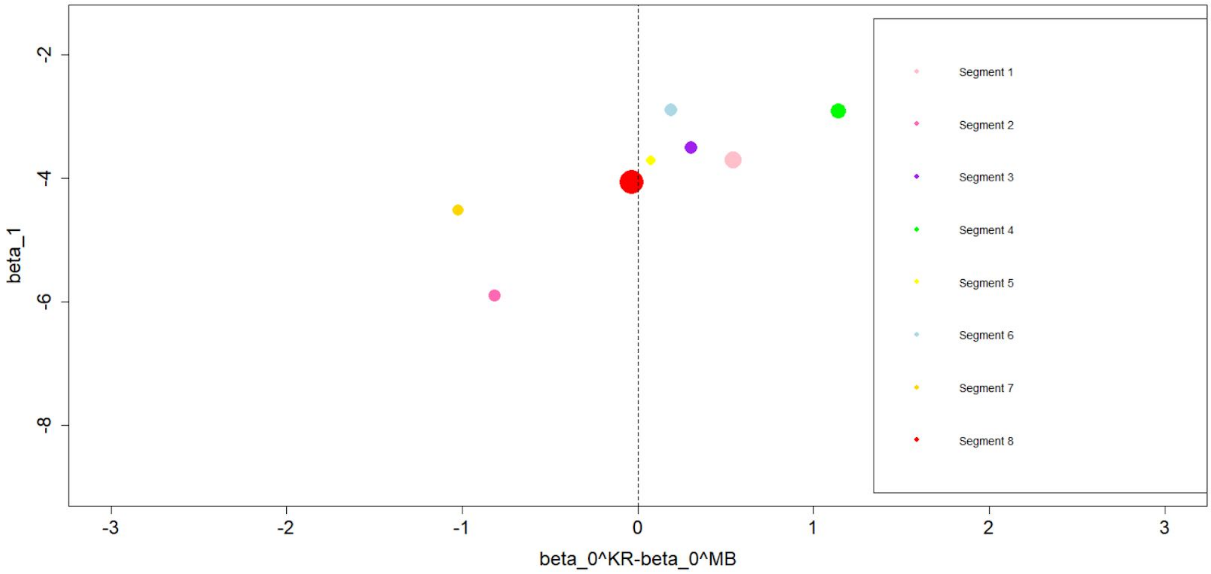
The cross-elasticity from KR to KB without segmentation is 1.02, the highest value among all cross-elasticities, which shows that KR and KB are close substitutes among these three products. Therefore, segmentation help us explore the more accurate relationship between KR and KB that they are not so substitutes after taking demographic information into account.

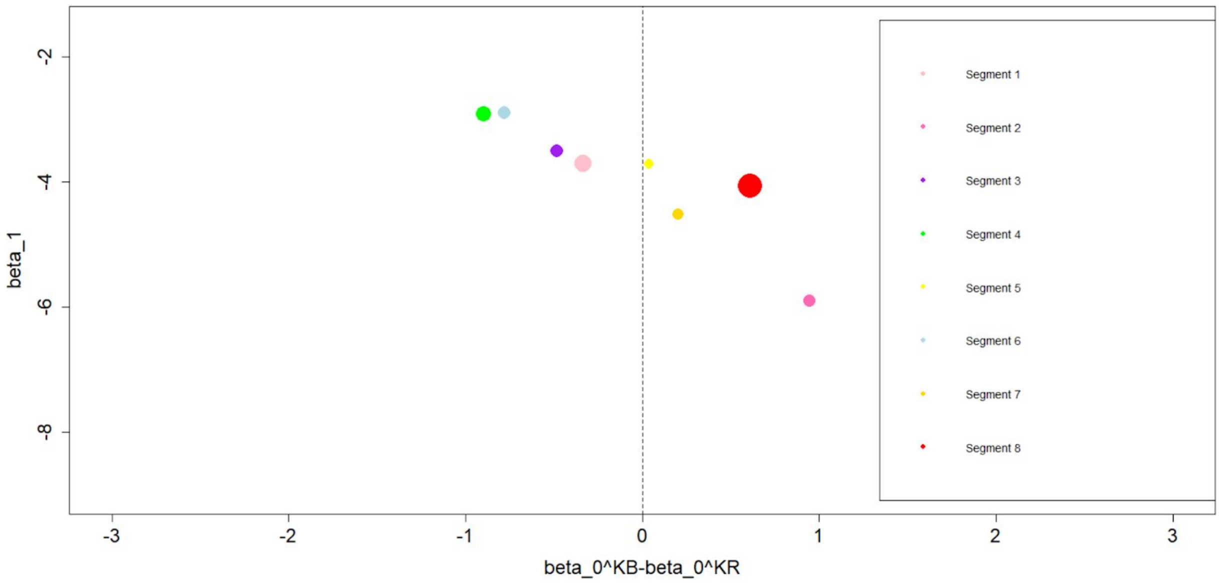
The result in segmentation case partially support the idea to launch KB as a new product, since KB has the largest cross-elasticity with MB(1.05), which means KB is an eminent close substitute of MB and launching KB will help Kiwi capture some current market shares of MB. Moreover, KB has the smallest cross-elasticity with KR(0.85), which means they are not as close substitutes and launching KB will not cause much cannibalization.

4.2 Segments' preferences

From the previous question, we reached a conclusion that launching KB can help Kiwi obtain some market share from MB with little cannibalization from KR. Next, we are going to further examine our conclusion from the aspect of segmentation.


-2
-4
-6
-8
beta_1
-3
-2
-1
0
1
2
3
beta_0^KB-beta_0^MB
Segment 1
Segment 2
Segment 3
Segment 4
Segment 5
Segment 6
Segment 7
Segment 8


-2
-4
-6
-8
beta_1
-3
-2
-1
0
1
2
3
beta_0^KR-beta_0^MB
Segment 1
Segment 2
Segment 3
Segment 4
Segment 5
Segment 6
Segment 7
Segment 8


-2
-4
-6
-8
beta_1
-3
-2
-1
0
1
2
3
beta_0^KB-beta_0^KR
Segment 1
Segment 2
Segment 3
Segment 4
Segment 5
Segment 6
Segment 7
Segment 8

From the first graph above (KB-MB), we can see that most segments lie closely around X=0, which means they are almost indifferent between KB and MB. So KB and MB can be regarded as closer substitutes. However, from the second (KR-MB) and third graph (KB-KR), we can see that some segments lie more distantly from X=0, which means they strongly prefer one product to another. So these KB&KR and KR&MB are not so close subsitutes. This result just verifies our conclusion in 4.1.

we can see that segment 1, 2, 4, 5, 8 have more preference for KB than MB and segment 2, 7, 8 have more preference for KB than KR. After taking an intersection, we recommend Kiwi to position KB to segment 2 and 8 if they decide to launch KB, because in this way they can capture as more market share as possible from MB and meanwhile generate the least cannibalization.

4.3 Strategic advantages of launching KB

We will demonstrate the strategic advantages of launching KB from two aspects: profit and segmentation coverage.

Let's look into profit at first.

Strategy	Optimal Price(s)	Maximum Profit
Not Launch KB	KR=$1.06	$292.4875
Launch KB	KR=$1.17 KB=$1.15	$396.5902

We can clearly see that launching KB can help Kiwi achieve higher profit.

As for the segmentation part, launching KB can help Kiwi obtain some potential consumers from segments that KR failed to reach. As the graph in 4.2 shown, consumers from segment 2 and 8 may be reached if KB was launched. Especially segment 8, which is not captured by demographic information but accounts for 21.2% of total segment population, has high preference for KB. Hence, together with segment 2 (10.6%), launching KB provides Kiwi with opportunity to reach extra potential consumers and contributes to Kiwi's market share expansion.

5 Understanding strategic responses

In this part, we want to discover Kiwi's optimal price(s) and profit in a scenario with competitive reaction, which means Mango's profit maximization pricing responses should also be considered into calculation. To decide whether Kiwi should launch KB or not in this more real-world-like scenario, we simulated the pricing procedure of both Mango and Kiwi, and calculated Kiwi's maximum profit by the end of the "pricing war". The point here is to see whether we should continue to include KB into product line considering Mango's strategic responses.

5.1 Pricing war simulation without KB's launch

As demonstrated in 4.3, when KB is not in the market, Kiwi's optimal price for KR is $1.06. Since Mango is able to figure out the optimal price to maximize its profit, the optimal price for MB would becomes **$0.98**, which brings a profit of $202.897, further exceeding the previous profit of $107.0242 if the price of MB keeps unchanged at $1.43, which means that Mango is overcharging.
As a result of competitive reaction, Kiwi would then respond to Mango's new price by lowering its price to $0.97, which would further drive Mango to price MB at $0.96. Here Kiwi and Mango would reach the Nash Equilibrium and stop the pricing war.

optimal price.KR	optimal price.MB	Kiwi's max profit
$1.06 =>	$0.98	$292.4875
$0.97 =>	$0.96	$197.9785
$0.97 =>	**$0.96**	**$192.5945**

Without KB launch, Kiwi can make up to **$192.5945** considering Mango's competitive reaction.

5.2 Pricing war simulation with KB's launch

According to 4.3, when KB is launched, Kiwi has a product line of KB and KR, for which the optimal prices are $1.15 and $1.17 respectively. In this case, Mango would price MB at **$0.95** gain most profit ($180.6231), which outnumbered the profit of $89.2181 if MB's price keeps unchanged at $1.43.
Faced with Mango's new price, Kiwi would respond by lowering prices of both products, selling KB at $1.02 and KR at $1.06. As a result, Mango would further cut MB's price to $0.92. Kiwi would then price at $1.01 and $1.05, causing Mango to price at $0.91, where they reach Nash Equilibrium and don't bother further decreasing their prices.

optimal price.KB	optimal price.KR	optimal price.MB	Kiwi’s max profit
$1.15 +	$1.17 =>	$0.95	$396.5902
$1.02 +	$1.06 =>	$0.92	$274.4639
$1.01 +	$1.05 =>	$0.91	$264.1354
$1.01 +	**$1.05** =>	**$0.91**	**$260.6774**

With KB’s launch, Kiwi can make up to **$260.6774** considering Mango’s competitive reaction.

5.3 Conclusion and final recommendation

In the competitor reaction context, launching KB generates $260.6774 total profit, which is conspicuously higher than $192.5945 without KB’s launch. Considering all the analysis above, we recommend Kiwi to launch KB.