Pricing Analytics Project 2:

Kiwi Bubbles

Takeaki Sunada

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1 General notes

Please send your report (one per team), your .R script and an HTML file compiled by Rstudio (more on this next paragraph) by Thursday, Feb 13th at 8 am to "MKT440submission2020@gmail.com".

The HTML file we request can be generated by selecting "files - compile report" in Rstudio console. It then automatically runs your R code and report all results side by side with your code. This document really helps our TAs in grading projects.

Please clearly indicate names of team members at the top of the report. Optionally, each team member can submit peer-evaluation form (available on blackboard) to indicate main contributor for your project.

Several pieces of advice:

1. Please read the whole document before you begin. The volume of the questions may (again) seem terrifying. However, there are a lot of situations where you can simply reuse your code from previous questions. For example, note that you may need to solve Kiwi and Mango's optimal pricing multiple times in Section 5. Keep that in mind when you write your code of Kiwi's optimal pricing in section 4.

2. You may reuse my lecture codes. However, make sure you implement any necessary edits to deal with the difference between lecture data sets and project 2 data sets. While they look similar, they are indeed different data sets.

3. Note that in (part of) lecture 4, we did "profit maximization over two products, but with a single segment". In lecture 5, we did "profit maximization with multi-segment, but with one product". Here, we do "profit maximization with multi-segment and multi-product". Hence you need to code things accordingly.

4. The latter part of the project asks you to discuss positioning of Kiwi Bubbles. If you don't find anything meaningful in your estimated demand in that question, you may have got the segmentation incorrect - try some different number of segments.

2 Environment

It is late 90s. You are the product and pricing manager of Kiwi, a major soft drink company. You own and sell "Kiwi Regular" and the product currently is doing well in the market. Your main competitor, Mango, produces "Mango Bubbles" that is well-received in the market as well. Your guess is that Mango does well because consumers prefer "Bubbles" over "Kiwi" – but you have the better brand name than Mango, thus your product also does well. Now, a spark comes to your mind: why not launching a new product, "Kiwi Bubbles"? The product combines the best of characteristics "Bubbles" and your brand name "Kiwi", and should be able to do well, right? You launch the product in a test market and collected consumer loyalty card data to aid your global launching and pricing decisions. For the entire project, assume that all 3 products have $0.50 unit costs and market size is 1000 consumers. We have a subsample of the data set, "kiwi_bubbles_P2.csv" (note that this is *a different data set* from the one we use in the lecture). The data set records the choices of soft drink of 359 consumers over the course of 3 years. The columns, from left to right, are 1) consumer ID, 2) week code, 3) softdrink-buying trip number of the consumer in the sample period, and 4-7) prices of zero product (not buying), Kiwi Bubbles, Kiwi Regular and Mango Bubbles (99 means that product was out of stock), and 8) consumer choice. A consumer in a given week only buys one or none of the 3 products. We also have a demographic data-set, "demo.csv", for some of the consumers (whose rough description is available in "demo_description.xlsx"). Given that we have a choice data set, it is natural to start with a logit model.

3 Logit model without segmentation

Assume first that β_0^j and β_1 are common across consumers. In this case, the model collapses to a simple multinomial logit model. Follow (almost) exactly the lecture notes and estimate the model.

Using the estimated parameters, calculate own- and cross-price elasticities for all combination of products, evaluated at the average prices observed in the data. Do you see any particular patterns? Are the patterns reasonable, or something you are concerned about? Explain why (why not).

Finally, calculate optimal prices for KB and KR (note that you have two products) to maximize the profit when Mango price is $P^{MB} = 1.43$.

4 Logit model with segmentation

Now allow β_0^j and β_1 to differ across consumers with different demographics. Like what we did in the lecture, group consumers into segments using "kmeans" function. You may use all columns from the demographic data to do clustering. Then estimate multinomial logit model separately for each segment of consumers. Explain why you chose the number of segments you chose.

Now, use the estimated model to analyze and report (1) the strategic importance of launching Kiwi Bubbles, and (2) optimal pricing of KB and KR. In particular, consider the following questions (you may also consider other relevant questions if necessary).

- At the average prices observed in the data, what are the (product-level, aggregated across segments) own- and cross- elasticities among these products? How does it differ from the no-segmentation case? Which products are closer substitutes and which products are not as close substitutes?

  - Because we have segmentation, the simple logit elasticity formula no longer applies. Hence you may calculate elasticities numerically - starting from the observed average prices, increase (or decrease) the price of each product by one percent, and evaluate how the aggregate choice probability of each product predicted by the model changes in response to that. Report percentile differences as your elasticity estimate.

  - The modified elasticity formula is available around page 47 of lecture slide 5. If we get there before the due date or if you want to take a look by yourself, you can use that formula instead of numerical derivation.

- Study the segments you found and their preference toward KB, KR and MB. How does the underlying customer segmentation explain the substitution pattern you see in the elasticity? From the substitution pattern and underlying segmentation, where (i.e. which segment(s)) should Kiwi Bubbles be positioned?

- Let's say Mango Bubbles is priced at $1.43 and does not react to Kiwi's pricing. Suppose first that you decided not to launch Kiwi Bubbles - what is the optimal price of Kiwi Regular? Suppose next that you do launch Kiwi Bubbles - what is the optimal prices for Kiwi Regular

and Kiwi Bubbles? How does the profit of Kiwi and Mango change as Kiwi launches KB? Does the model justify the launch of KB? *Why (why not)*? Don't just say "yes because profit is higher with Kiwi Bubbles" (or whatever). You have been studying consumer segments and product positioning in this question - there are things you should be able to say from these aspects.

You may study these questions one-by-one, or write a report that includes these aspects mixed together. The writing style is up to you. Your objective is to explain the strategic advantage/disadvantage of launching Kiwi Bubbles to your boss.

5 Understanding strategic responses

You now consider strategic actions from your competitor, Mango. You realize that Mango might be as smart as you are in that they might also realize their $1.43 price might not be optimal. This is to say, in the previous question, you assumed that Mango maintains its price at $1.43 regardless of what you do. Suppose now instead that they react and set an optimal price against your new prices, and you need to set an optimal prices against their new price, and so on. Where does this "pricing war" converge at? How does your description of the strategic advantage of launching Kiwi Bubbles differ (or stay the same) between the previous "no competitive reaction" scenario and this "pricing war" scenario?

Specifically, you may follow the following steps to answer to this question.

- First, solve Mango's optimal pricing problem, given that Kiwi's price is the one you set from the previous section. Is their new price higher or lower than $1.43?

- As Kiwi, you need to react to Mango's new price. Set prices for KR and KB to respond to the new price of Mango Bubble that we just derived.

- Repeat the previous two steps iteratively, until neither Kiwi nor Mango has an incentive to set a different price (you can be as accurate as one cent, but no need to be more accurate than that). These set of prices are the new "equilibrium price" where you and Mango compete with each other. Please report the sequence of prices until you reach here, and you may argue the strategic advantage of Kiwi Bubbles at these prices.

- Technical notes: I expect that this iterative process should converge around 4-5 iterations (compute optimal prices for Kiwi and Mango 4-5 times each). Hence you may just "copy and paste" the previous codes you used to calculate optimal prices four times - conceptually, you just do the same thing repeatedly with different rival price as a starting value. If you don't like such a lengthy code, you may instead write the whole process of deriving optimal prices for each company as a function, and you just call that function at each iteration.