**ASSIGNMENT – 2 (MILONI DESAI)**

1) How many Factors would you select to summarize the survey data? Are you able to interpret the factors based on the Unrotated Factor Loadings? If not then mention what problems you are facing in interpreting the Unrotated factors.

Ans) When we carry out the principal component analysis, we see that taking one factor gives us 53.75% information about the data. Taking two factors gives us 74.68% information about the data, while taking three factors gives us gives us 91.7% information about the data. Now if we decide to take four factors into the analysis, we they describe 96.53% of the data. But the increase of less than 5% is not enough for us to include an extra factor into the analysis as this negates the purpose of factor analysis. Thus, we select three factors to summarize the data.

**Code:**

# Step1: Principal Components Analysis (PCA)

Infinity\_G20.pc = prcomp(Infiniti\_G20[2:10], scale = T)

summary(Infinity\_G20.pc)

**Output:**

Importance of components:

PC1 PC2 PC3 PC4 PC5 PC6 PC7 PC8 PC9

Standard deviation 2.1995 1.3724 1.2375 0.65989 0.44843 0.27872 0.1406

Proportion of Variance 0.5375 0.2093 0.1702 0.04838 0.02234 0.00863 0.0022

Cumulative Proportion 0.5375 0.7468 0.9170 0.96534 0.98768 0.99631 0.9985

Standard deviation 0.11511 0.01356

Proportion of Variance 0.00147 0.00002

Cumulative Proportion 0.99998 1.00000



The same can also be seen from the scree plot, that starts tailing off from the 4th factor.

**Code:**

# Step2: Factor Analysis without any rotation

Infinity\_G20.fa1 = principal(Infiniti\_G20[2:10], nfactors = 3,

rotate = "none")

Infinity\_G20.fa1$loadings

Infinity\_G20.fa1$communality

**Output:**

Loadings:

PC1 PC2 PC3

Attractive 0.890 -0.436

Quiet 0.922

Unreliable -0.643 0.728

Sporty -0.619 -0.670 0.119

Uncomfortable -0.849 -0.371 0.166

Roomy 0.700 0.584 -0.175

Prestige 0.919 -0.231 -0.263

Economical 0.384 0.903

PoorValue -0.585 0.186 -0.753

PC1 PC2 PC3

SS loadings 4.838 1.883 1.531

Proportion Var 0.538 0.209 0.170

Cumulative Var 0.538 0.747 0.917

Infinity\_G20.fa1$communality

Attractive Quiet Unreliable Sporty Uncomfortable

0.9877562 0.8529944 0.9429247 0.8457272 0.8863938

Roomy Prestige Economical PoorValue

0.8621237 0.9673214 0.9631911 0.9441433

We can see from the unrotated factor loadings that they are quite correlated(inversely). Hence, they do not give us enough information. Thus, we to know more about the data, we need the factor loadings to be completely uncorrelated so that they can together give us information about different aspects of the data and summarize it completely. These are the problems faced while working with the unrotated factor loadings.

2) Use Varimax Rotation to find the Rotated Factors. Describe the Factors as

clearly as possible and give appropriate names for these Factors.

Ans)

**Code:**

# Step2 (contd. - optional): Factor Analysis with Varimax rotation

Infinity\_G20.fa2 = principal(Infiniti\_G20[2:10], nfactors = 3, rotate = "varimax")

Infinity\_G20.fa2$loadings

Loadings:

RC1 RC2 RC3

Attractive 0.950 0.267 0.122

Quiet 0.657 0.622 0.187

Unreliable -0.966

Sporty -0.914

Uncomfortable -0.365 -0.867

Roomy 0.110 0.921

Prestige 0.824 0.511 -0.164

Economical -0.216 0.954

PoorValue -0.570 -0.783

RC1 RC2 RC3

SS loadings 3.462 3.177 1.614

Proportion Var 0.385 0.353 0.179

Cumulative Var 0.385 0.738 0.917

Infinity\_G20.fa2$communality

Attractive Quiet Unreliable Sporty Uncomfortable

0.9877562 0.8529944 0.9429247 0.8457272 0.8863938

Roomy Prestige Economical PoorValue

0.8621237 0.9673214 0.9631911 0.9441433

From the rotated factor loadings, we can see that each of the factors, PC1, PC2 and PC3 all uniquely describe one variable in great detail. Thus, from the from the table we can see that we can combine all the attributes into three factors. Below is the breakdown of the same:

RC1: Desirability = {Attractive, Quiet, (Unreliable with a high negative correlation) Reliable, Sporty}

RC2: Utility = {Roomy, (Uncomfortable with a high negative correlation) Comfortable}

RC3: Reasonability = {Economical, (Poor Value with a high negative correlation) High Value}

3) Use the factor scores to generate perceptual maps. Based on these maps,

how do people in this market perceive the Infiniti G20 in comparison with the other

cars? For each of the factors, who is/are perceived to be the closest competitor(s) of

G20? Who is/are the perceived leader(s) on each of the factors?

Ans)

**CODE:**

#PERCEPTUAL MAPS

#We'll use different colors for the car models, with Cars.df$ID\_Car

# as the 'grouping factor' (If we used Cars.df$Car then the colors

# would be assigned in alphabetical order of the Car model names)

# Colors:

# 1. G20 = "tan"

# 2. Ford T-bird = "navy"

# 3. Audi 90 = "cyan"

# 4. Toyota Supra = "limegreen"

# 5. Eagle Talon = "brown"

# 6. Honda Prelude = "violet"

# 7. Saab 900 = "yellow"

# 8. Pontiac Firebird = "red"

# 9. BMW 318i = "pink"

#10. Mercury Capri = "black"

plot(RC2 ~ RC1, data = Infinity\_G20.fa2$scores, pch = 22, lwd = 0.5,

bg = c("tan", "navy", "cyan", "limegreen", "brown", "violet", "yellow", "red", "pink", "black")[Infiniti\_G20$Car],

xlab = "Desirability", ylab = "Utility",xlim = c(-2,2), ylim = c(-2,2))

abline(h=0, v=0, lty = 2)

legend("topright", title = "Car Model", text.font = 3, inset=.02, bg='gray90', pt.cex = 2, cex = 0.6,

c("G20", "Ford T-bird", "Audi 90", "Toyota Supra", "Eagle Talon",

"Honda Prelude","Saab 900","Pontiac Firebird","BMW 318i","Mercury Capri"),

fill = c("tan", "navy", "cyan", "limegreen", "brown", "violet", "yellow", "red", "pink","black"))

#SECOND PERCEPTUAL MAP

plot(RC3 ~ RC2, data = Infinity\_G20.fa2$scores, pch = 22, lwd = 0.5,

bg = c("tan", "navy", "cyan", "limegreen", "brown", "violet", "yellow", "red", "pink", "black")[Infiniti\_G20$Car],

xlab = "Utility", ylab = "Resonability",xlim = c(-2,2), ylim = c(-2,2))

abline(h=0, v=0, lty = 2)

legend("topleft", title = "Car Model", text.font = 3, inset=.02, bg='gray90', pt.cex = 2, cex = 0.6,

c("G20", "Ford T-bird", "Audi 90", "Toyota Supra", "Eagle Talon",

"Honda Prelude","Saab 900","Pontiac Firebird","BMW 318i","Mercury Capri"),

fill = c("tan", "navy", "cyan", "limegreen", "brown", "violet", "yellow", "red", "pink","black"))

#THIRD PERCEPTUAL MAP

plot(RC3 ~ RC1, data = Infinity\_G20.fa2$scores, pch = 22, lwd = 0.5,

bg = c("tan", "navy", "cyan", "limegreen", "brown", "violet", "yellow", "red", "pink", "black")[Infiniti\_G20$Car],

xlab = "Desirability", ylab = "Resonability",xlim = c(-2,2), ylim = c(-2,2))

abline(h=0, v=0, lty = 2)

legend("topright", title = "Car Model", text.font = 3, inset=.02, bg='gray90', pt.cex = 2, cex = 0.6,

c("G20", "Ford T-bird", "Audi 90", "Toyota Supra", "Eagle Talon",

"Honda Prelude","Saab 900","Pontiac Firebird","BMW 318i","Mercury Capri"),

fill = c("tan", "navy", "cyan", "limegreen", "brown", "violet", "yellow", "red", "pink","black"))

## ##

###### Perceptual Map for aggregate perceptions ######

## ##

# Appending Cars.df with the factor scores

Cars.df[10:11] = Cars.fa2$scores

names(Cars.df)[10:11] = c("Allure", "Luxury")

# Aggregate factor scores by car model

Cars.scr.mean = aggregate(.~Car, data=c(Cars.df[3], Cars.df[10:11]), mean)

View(Cars.scr.mean)

plot(Luxury ~ Allure, data = Cars.scr.mean, pch = 22, bg = "darkviolet",

xlab = "Allure", ylab = "Luxury",

xlim = c(-2,2), ylim = c(-2,2))

text(Luxury ~ Allure, labels = Cars.scr.mean$Car, data = Cars.scr.mean, font = 2, pos = 2)

abline(h=0, v=0, lty = 2)

**OUTPUT:**

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From the perceptual map for Desirability and Reasonability we can see that the closest competitors of G20 (Marked in the map above) are the Pontiac Firebird and the Toyota Supra.

The leaders in the Desirability and Reasonability space would be the Honda Prelude, BMW 318i and the Ford T-bird.



From the perceptual map for Desirability and Utility we can see that the closest competitor of G20 (Marked in the map above) is the BMW 318i.

The leaders in the Desirability and Utility space would be the Eagle Talon, BMW 318i and the Ford T-bird.

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From the perceptual map for Utility and Reasonability we can see that the closest competitors of G20 (Marked in the map above) are the Eagle Talon and the BMW 318i

The leaders in the Utility and Reasonability space would be the BMW 318i and the Ford T-bird.

From the three perceptual Maps we can see that for the following factors the competitors of G20 are:

1. Desirability: Pontiac Firebird
2. Utility: BMW 318i
3. Reasonability: Pontiac Firebird, Mercury Capri and the Toyota Supra.

From the three perceptual Maps we can see that for the following factors the leaders are:

1. Desirability: Mercury Capri, Eagle Talon and the Ford T-bird
2. Utility: G20
3. Reasonability: Honda Prelude and the Audi 90

4) Infiniti promoted the G20 as a Japanese car (basic version $17,500) with a German feel. That is, as a car that was like the BMW 318i ($20,000), but lower priced. Do the perceptions of the respondent’s match with this claim?

Ans) If the “German Feel” is equated with Desirability then we can see that the perceptions of the respondents do not match the claim as they perceive the BMW 318i to be more reasonable and desirable.

If the “German Feel” is equated with Utility then we can see that the perceptions of the respondents do not match the claim as they perceive the G20 to have a higher utility but still think of the BMW 318i to be more reasonable (aka cost effective).

5) Find the correlations between each consumer sub-segment’s overall ratings (Columns S1, S2 and S3) with the factor scores (Hint: You should find one correlation coefficient for each factor-segment pair. This will tell you how the segment’s overall rating is correlated with that factor). How would you describe these segments based on these correlations and the characteristics of each segment (Exhibit 3)?

Ans)

**Code:**

Infiniti\_G20[14:16] = Infinity\_G20.fa2$scores

names(Infiniti\_G20) [14:16] = c("Desirability", "Utility", "Reasonability")

round(cor(Infiniti\_G20[11:16]), digits = 3)

S1 S2 S3 Desirability Utility Reasonability

S1 1.000 0.443 0.741 0.782 0.512 0.238

S2 0.443 1.000 0.067 0.049 0.757 0.196

S3 0.741 0.067 1.000 0.718 0.085 0.607

Desirability 0.782 0.049 0.718 1.000 0.000 0.000

Utility 0.512 0.757 0.085 0.000 1.000 0.000

Reasonability 0.238 0.196 0.607 0.000 0.000 1.000

Desirability ---- S1, S3

Utility ---- S1, S2

Reasonability ---- S3

From the correlation coefficients we can see that segment 1 respondents look for cars that are desirable and have a good utility. From Exhibit 3 we can see that these white people with high paying salaries seem to be at good positions in the industry. Thus, it explains their preference for highly desirable features as the key features in the cars they buy. We can also see that respondents like to sail, scuba dive or ski. As the equipment’s for such outdoorsy activities take up some room and need to be transported, they require cars that also have a good utility. Being professionals in the industry they tend to go for cars that have flashy features and make a statement (aka desirability).

We suggest Eagle Talon, BMW 318i and the Ford T-bird for segment 1 based on their preferences.

For the correlation coefficients of segment 2 we can see that they give prime importance to the Utility of the car. As on an average these families tend to have 4 people per house, they need roomy cars with a good value. They are also big on fishing and hence need high utility cars to drive up to these locations with the fishing equipment that tends to take up a considerable amount of space.

We suggest the G20 based on their requirements.

From the correlation coefficients of segment 3 we can see that they place prime importance on the Reasonability and Desirability. Being the segment with the relatively lowest income among the three segments, we can see why they place importance of value over flashy features. We also see that this segment rents the most movies and reads a fair amount of movie magazines. We could infer that they are influenced by what they see in these films and tend to want desirability

Based on their preferences we suggest the Honda Prelude, BMW 318i and the Ford T-bird.

6)To which sub-segment(s) would you market the Infiniti G20 (You should clearly discuss the pros and cons for each sub-segment)? How would you position/reposition the Infiniti G20 to best suit the chosen sub-segment(s)? Based on the information provided in the Exhibits, briefly describe the marketing program, media strategy, etc. that you might use to target the chosen sub-segment(s)

Ans) From our analysis we I think I would market the G20 in segment 2.

Pros and Cons for each segment are as follows:

|  |  |  |
| --- | --- | --- |
| SEGMENT 1 | SEGMENT 2 | SEGMENT 3 |
| PROS:   * Higher spending power. * Need vehicles as are more likely to travel for outdoorsy activities. * Watch more TV at night and are likely to wake up late in the mornings and rush for work. Hence cannot depend on public transport and need their own vehicles. | PROS:   * Considerable spending power. * Larger families. * Watch daytime television and hence are easier to target via advertisements. * Read magazines about infants and parenting (explained later). * Go fishing | PROS:   * Average number of people per household. * Watch a fair amount of late night TV and are likely to need their own vehicles in the morning to get to work. * Read entertainment magazines * Have Amex cards hence can be targeted via offers on the card (monthly installments) * Big on outdoor sports. |
| CONS:   * Give prime importance to the features of the car and its flashiness over utility. * Generally smaller families. * Read more business magazines and tend to make decisions on performance of brands over the product. | CONS:   * Don’t read business and tech magazines and hence are not aware about technical specs that improve the performance of vehicles. | CONS:   * Less spending powers. * Watch less daytime television. * Don’t read business and tech magazines and hence are not aware about technical specs that improve the performance of vehicles. |

Based on the data seen in the exhibits I would reposition the G20 in the second segment and rebrand it as the “Family Car”. Whenever someone talks about the G20, our marketing strategy would be so executed that the word Family car would become synchronous with the G20.

We would start by showing off the features of the G20 most often seeked out by the respondents in the second segment, aka how roomy it is and the good value it provides on the road. Marketing it as a family car goes over and above being roomy and value for money and mileage. It is about building trust. Your customers must trust the quality and safety provided by the car to be able to tag your product as one they would trust their near and dear ones lives with.

Thus, the marketing strategy aims to make sure that the product connects with the customers on a sentimental level and earns their trust.

When we come to the media strategy this is where a large part of the marketing strategy takes form. Segment 2 has a lot of respondents who watch daytime television. Thus, prime time advertisements are the best way to catch their attention. The data also shows that this segment rents the most number of movies, almost 85%. From this inference we can safely bring on board popular celebrities to market our product by being in the day time advertisements. Another inference that can be drawn from this data is that the respondents in this segment like theater and drama. The best way to get something into their memory would be through strong storytelling as opposed to segment one who read business and technology magazines and would probably consume information better when they read and hear specifications of the product in technical terms.

Respondents in this segment seem to have children and read a lot of parenting books. Thus, we can aim to market the G20 as the next minivan often referred to as the most family oriented car a mother drives in the United States. When we place the G20 in the market, we are targeting not just families but also mothers who drive carpools for their children or pick up and drop their children to school on a daily basis. The safety, ease of use and spaciousness come to the forefront yet again. With a 45% size, this segment is perfect for the G20, as is the G20 for the respondents of this segment as it meets most of its needs.

Now let’s look at some technical specifications of the G20 that could potentially be leveraged into this campaign.



The G20 is priced at $ 17,500 which is affordable. The LXWXH dimensions further reveal how spacious it is and thus can be used by a family and to carry fishing equipment, another activity which a routine for a large chunk of the respondents in segment is 2.

The G20 has the best fuel efficiency among the cars, which makes me a good car to drive not just in the city but also for trips outside the city (fishing trips).

The G20 offers a 4-year warranty / 60K miles both of which are a factor that help build trust and make sure that the families have something to fall back on in case something goes wrong.

Thus, the G20 can be best placed in S2 as the “Family car of every family in the United States”.