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Multivariate Statistics Term Paper

Introduction

Sustainable packaging is emerging as a key consideration in consumer buying decisions in the high-end cosmetics sector. When it comes to brands like Givenchy, the package not only fulfills its purpose of containing and transporting the product but also carries consumer values with respect to the virtue of sustainable as well as ethical purchasing.

This term paper focuses on analyzing data from the consumer study done by Givenchy in the decorative cosmetics market. Within the study, the effect of the material used in the packaging, sustainability criteria, functionality, color, and price is considered in relation to the purchasing preferences of the target consumers. By employing multivariate statistical analysis, the aim is to determine the nature of the packaging elements that influence the purchasing preference and the sustainability elements desired by the target market.

Methodology

The analysis relies on a consumer choice test that took place by the firm Givenchy in the decorative cosmetics category. The essential parts of the analysis are:

- The respondents were asked to assess a **series of packaging options** that integrated material type, color, sustainable characteristics, use-related features, and pricing.
- The **dependent factor** was **buying preference**.
- **Categorical variables** were modeled using **dummy variables**.
- The model of multiple **linear regression was used to estimate part-worth utilities for attributes.**
- **'B' values**, which are the **unstandardized coefficients**, are used to calculate the **relative importance** and **visualize in Python.**

Such an approach enables the research to quantify the intensity with which each attribute in the package affects the consumer's buying preference while accounting for all other variables

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Regression

Variables Entered/Removed

Model	Variables Entered	Variables Removed	Method
1	Price, Refill-Possibility, QR-Code, CrueltyFree, Veganblume, Recycled Plastics, brown, Biobased Materials, green, Glass, black[b]	.	Enter

a. Dependent Variable: Buying Preference

b. All requested variables entered.

NOTE

The unstandardized regression coefficients "B" was used as inputs for producing bar diagrams in Python to display part-worth utilities and attribute importance. The bar diagrams are more effective in representing results similar to tables in SPSS in order to assist in understanding consumers' purchasing behaviors.

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Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.415[a]	.172	.169	.984

a. **Predictors: (Constant), Price, Refill-Possibility, QR-Code, CrueltyFree, Veganblume, Recycled Plastics, brown, Biobased Materials, green, Glas, black**

The regression equation reveals that there is a relationship between packaging variables and consumer preferences (R = .415).

NOTE – In marketing and any kind of consumer data, if anything above ,30 which means the features already matter, they are good.

If R = 0 (means model is useless)

If R =1 (Model predicts perfectly)

So, here it is 415 means that's moderate, real relationship.

The **R-Squared value (.172)** implies that only **17.2% of the variance in consumer preferences is accounted** for by the most significant variables in this study, which include product variables such as product color, material, sustainability, product properties, and price.

The **Adjusted R-Squared value (.169) is very close to R-Squared**, and this implies that we have **a good regression** equation that does not include unnecessary variables. The model is **stable and not outfitted.**

Thus, overall, the regression model provides a sturdy and reliable foundation for understanding the role that specific packaging variables play in driving decision

making regarding purchases, and it allows us to interpret the significance and impact of each variable.

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	522.535	11	47.503	49.085	<.001[b]
	Residual	2512.359	2596	.968		
	Total	3034.894	2607			

a. Dependent Variable: Buying Preference

b. Predictors: (Constant), Price, Refill-Possibility, QR-Code, CrueltyFree, Veganblume, Recycled Plastics, brown, Biobased Materials, green, Glas, black

The ANOVA test is used to determine whether the overall regression model is significant. The test indicates that there is a significant **F-statistic value of 49,085** and a significance level of less than **.001**. Because the **p-value is less than ,001**, it means there is **less than a 0,1% chance** that this result happened randomly. That's why the probability is very low and the model is statistically significant. This set of variables affects buying preferences.

As per **hypothesis** theory:

Packaging features have **no effect** on buying preference.

Then the results would be **Null hypothesis** (H_0), means **retained** hypothesis.

But here, **ANOVA** result says:

Features clearly **affect** buying preference.

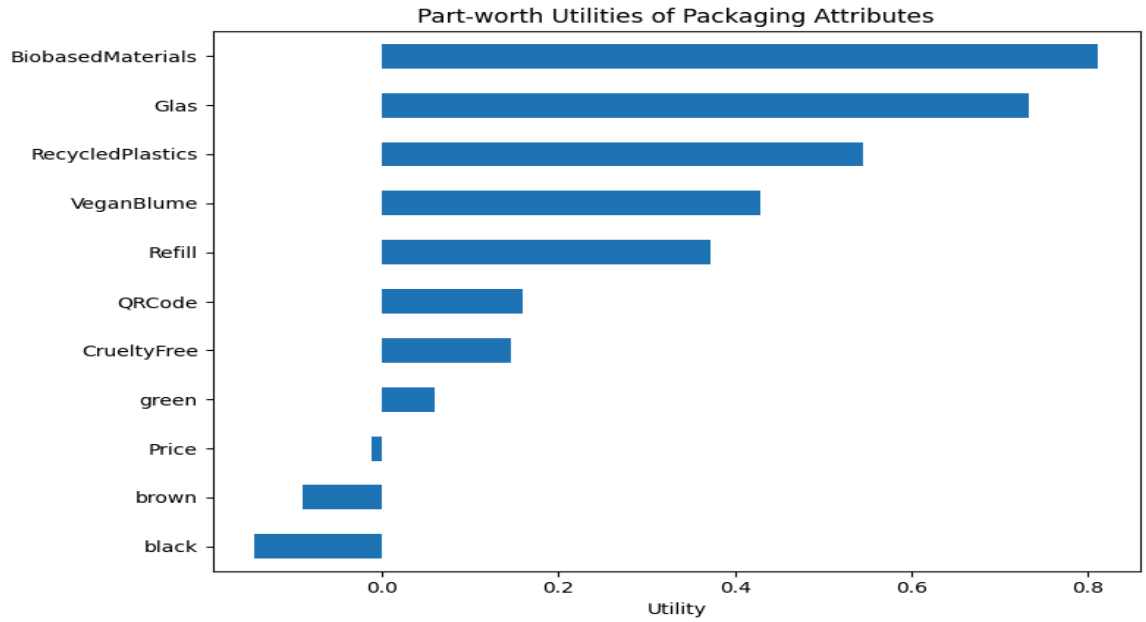
So, it is **Alternative hypothesis (H_1)**, we will **reject the null hypothesis**.

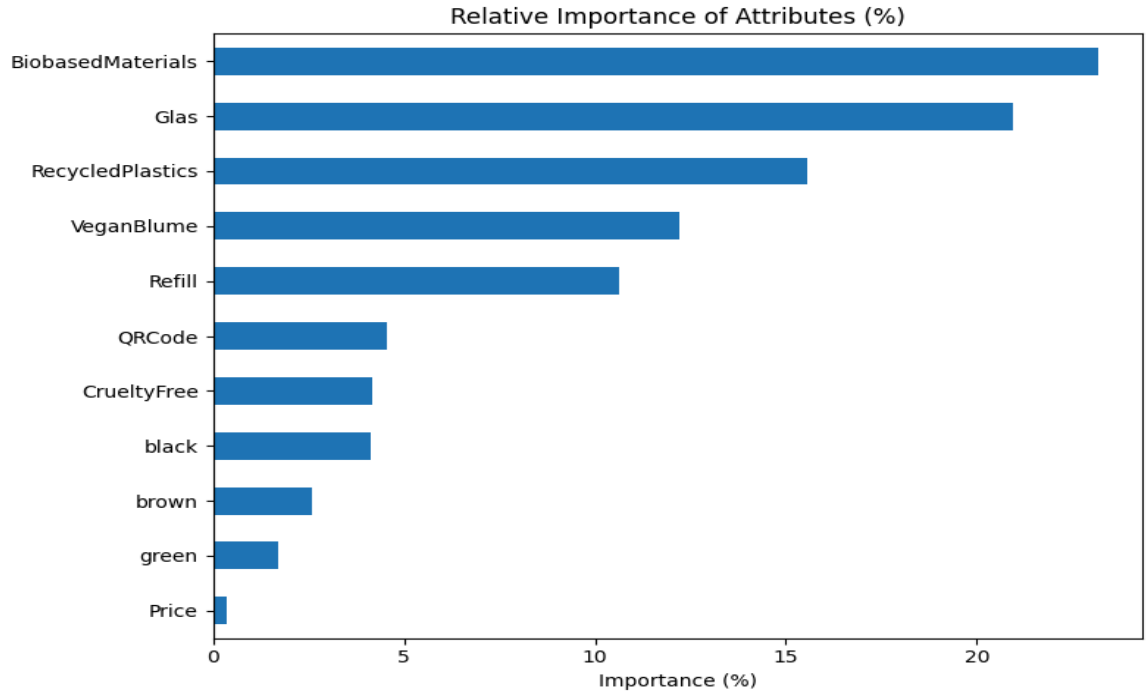
Reject H_0 and **accept H_1.**

In short, **the color, material, sustainability, key feature, and price** of the packaging all combine as predictors to **significantly differentiate** consumer assessment of the product. Since the total model is **significant**, it becomes valid to investigate the individual regression coefficients in an attempt to determine the predictors of buying preference.

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.234	.127		17.556	<.001
	black	-.144	.054	-.058	-2.646	.008
	green	.060	.054	.024	1.098	.272
	brown	-.090	.054	-.036	-1.661	.097
	Glas	.733	.054	.294	13.456	<.001
	Biobased Materials	.811	.054	.326	14.891	<.001
	Recycled Plastics	.544	.054	.219	9.993	<.001
	Veganblume	.428	.039	.198	11.107	<.001
	CrueltyFree	.146	.039	.068	3.782	<.001
	QR-Code	.160	.039	.074	4.140	<.001
	Refill-Possibility	.373	.039	.173	9.674	<.001
	Price	-.012	.006	-.038	-2.101	.036





Source:
The part-worth utilities shown in these charts are the unstandardized regression coefficients (B) from the SPSS Coefficients table.
The relative importance values were calculated in Python by normalizing the absolute coefficient values.

This part of Coefficients table explains

Which attribute increases buying preference, which one decrease. Which are significant or not and what that all means to customers.

Interpretation of Coefficients

Coefficients explain the impact of individual product characteristics on **consumer preference** for buying while other characteristics are kept unchanged. A **positive sign** indicates an increase in **consumer preference for buying**, while a **negative sign reveals a decrement**.

B- STANDS for 'B' Column.

Among the **packaging materials**, **biobased material** (B= .811) has the strongest **positive effect**, followed by **glass material** (B= .733) and **recycled plastic material** (B= .544). This indicates that consumers greatly prefer **green packaging materials,** especially the use of **biobased material packaging and glass material packaging**.

These **sustainability and ethics** alignment factors are significant. Both **Veganblume** (.428) and **cruelty-free** (.146) are **significant factors in buying preference,** which indicates that the **vegan and cruelty-free** factors contribute **positively** to consumer-perceived value.

Functional properties also increase their values beyond the point of purchase. The **refill ability** (B = .373) has a highly positive effect on purchases, and this suggests that

consumers appreciate being able to reuse their packaging. Scanning ability through a **QR code** also has a **positive effect on purchase** preferences (B = .160).

Price has a **normal negative effect** on the probability of buying the product

B = -.012.

For the **color dimension**, **black color** (B = **−**,144) is **negative,** suggesting that the use of black color will **decrease the attractiveness** of the product. **Green color** (B = ,060) and **brown color** (B = **−**,090) **have small effects**, suggesting that these **colors do not affect** the purchasing preference significantly.

In general, the coefficients show that **packaging material and sustainability** factors are the most **prominent ones** in determining the consumer's preference on what to buy, while **price** and certain product **colors** can **lower their appeal**.

Coefficients[a]

Model		95.0% Confidence Interval for B	
		Lower Bound	Upper Bound
1	(Constant)	1.985	2.484
	black	-.251	-.037
	green	-.047	.167
	brown	-.197	.016
	Glass	.626	.840
	Biobased Materials	.705	.918
	Recycled Plastics	.438	.651
	Veganblume	.352	.503
	CrueltyFree	.070	.221
	QR-Code	.084	.235
	Refill-Possibility	.297	.448
	Price	-.024	-.001

a. **Dependent Variable: Buying Preference**

This aspect in the Coefficients table holds significance due to
Which attribute has intervals that didn't cross zero, and all the effects are actually real?

The **95% confidence intervals** respectively indicate that there might be a **certain range** where the true value for each product attribute **could lie,** and this is based

on 95% confidence. A result is **statistically significant** if the confidence interval **does not contain zero.**

The confidence interval for **glass** (0.626 to 0.840), **biobased material** (0.705 to 0.918), and **recycled plastic** (0.438 to 0.651) lies completely in the **positive region**, which reiterates the fact that the **packaging material has a positive influence on the buying preference.** It can be concluded that the consumer favors sustainable packaging.

Likewise, the **confidence intervals** for **Veganblume** (0,352 to 0,503), **cruelty-free** (0,070 to 0,221), **QR code** (0,084 to 0,235), and **refill possible** (0,297 to 0,448) also do not contain zero, indicating that these variables enhance the buying preference because they **positively impact.**

The confidence interval for **price** (-0.024, -0.001) is **strictly negative**, and this confirms that **increased prices decrease buying preference.**

For **black** (-0.251 to -0.037), the interval is also **fully negative**, showing that being **black significantly decreases buying preference.**

In contrast, the confidence intervals for the **green** (−0.047 to 0.167) and **brown** (−0.197 to 0.016) colors **include zero**, indicating that the effects of these colors on buying preference are **not statistically significant**. These **colors do not** have any distinct **influence** on the mentioned purchase preference.

In conclusion, the confidence intervals show that the **factors of materials, sustainability labels, functional features, and price effect are robust and not significantly affected by certain color factors of consumer choice and preference**.

Willingness-to-Pay Interpretation

The results show how **consumers trade off price against features of sustainability and packaging.**

- **Price hurts buying preference**, which simply means consumers are price-sensitive.
- **Biobased, glass**, and **recycled plastic** are considered to **be highly sustainable materials** that can easily **compensate for higher prices due to their exceptionally positive effects.**
- It is the **biobased material** that has an **intermediary position,** which presents the **greatest potential** to justify the price premium.
- **Ethical labels increase the perceived value** more, **Veganblume** and **Cruelty**-**Free**, enhancing it and **increasing the willingness** of consumers to pay more.
- **Functions** that make the product **refillable**, or **a QR code**, for example, provide an **added value** beyond the product itself.

On the whole, consumers are willing to accept higher prices in cases where sustainable materials, ethical labels, and functional benefits are combined.

Managerial Implications

Givenchy should take the following actions based on the results:

- Give high priority to **Biobased and Glass** for Sustainable and Premium ranges.
- Display the labels "**Veganblume**" and "**Cruelty-Free**" prominently on your product packaging to instill **greater trust and perceived value.**
- Adopt **refillable packaging** and use **QR codes** to improve **functionality** and **transparency**.
- **Do not use black packaging** for sustainable products since this **lower purchasing preference.**
- Emphasis on **investment in sustainability and functionality**, rather than variations in color.

In deriving its packaging design from this information, Givenchy will be able to enhance its image of sustainability as well as preserve its positioning within the premium brand segment.

Conclusion

The analysis indicates that packaging attributes are major drivers in shaping consumer buying preference for the luxury cosmetics market.

The key findings can be summarized below.

- The most **positive effects** on buying preference are by **sustainable materials,** particularly **biobased materials** and **glass**.
- **Ethical labels** such as **Veganblume and Cruelty-Free boost** perceived value ratings of products.
- Also, other **functional features** such as **refillability** and **QR code**s enhance consumer preference.
- **Lower purchase intention** is the result of **higher prices and black color packaging**, which is **followed by green and brown colors** as having a lesser influence.

What this suggests in general is that **sustainability is not just a marketing signal** but a very **real driver of consumer value**. Emphasizing sustainable materials, ethical certifications, and functional packaging design, Givenchy would be able to enhance its brand image by supporting premium pricing and long-term competitiveness.

Limitations and Future Research

Although there is a clear benefit to using regression analysis to inform policy decisions, there are a few points to consider:

- The model accounts for the moderate proportion of the buying preference and implies that there are various other factors like brand image and advertising, influencing the consumer behavior as well.

- However, only a limited set of properties of the packaging were used, as other aspects, like shape, size, font, and logo design, were not considered.

- Also, this study, it is based on purchase preferences and not purchase behavior, as purchase behavior may differ in real market conditions.

In future research, a set of design features could be incorporated, and a **combination of preferences and actual purchasing behavior** could be used for better relevance and robustness of the results.

Thankyou 😊