Conjoint Analysis Applied to Apartment Rental.

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I.   Study Design

For this application of the conjoint analysis technique, I decided to focus on property rentals, specifically apartments. I found this market interesting due to the different attributes that can influence such a significant decision as where to live. Moreover, it's a massive aspect that affects a large part of the population, which makes it easier to find participants for applying the technique.

Attributes Considered

The first attribute I considered for this service is the price, a key factor in an economy in crisis like that of Argentina. Additionally, this attribute is of great importance to tenants due to the limited housing supply and high demand, often leading to high prices.

Another relevant attribute for selecting a rental is the geographical area where the apartment is located. There are many aspects for which this attribute is important to consumers, including the area's security, proximity to work/family, and the area where the potential consumer grew up, among others.

Additionally, I considered the number of rooms in the apartment as another variable, a significant factor depending on the number of people living there or the minimum spaces that each consumer expects to have.

Finally, the availability of a balcony in an apartment can also be a differentiator for some consumers due to the brightness and outdoor connection it provides.

Levels of each attribute

For the price, it was decided to establish the attribute levels at $100,000, $150,000, and $200,000 per month. These values align with the rental combinations proposed for September-October 2023 in Argentina.

Regarding the geographical area, the decision was made to divide the levels into CABA (Autonomous City of Buenos Aires), GBA (Greater Buenos Aires) South, GBA North, and GBA West. Initially, considering specific neighborhoods was contemplated for a more detailed approach, but ultimately, these mentioned areas were chosen to determine if respondents had preferences or aversions to any specific zone.

Regarding the number of rooms, the survey targeted young adults, mostly without a consolidated family, so the decision was made to consider 1, 2, and 3 rooms. It was assumed that they wouldn't require a greater number of rooms.

Finally, balcony availability was divided into two levels: whether the apartment has a balcony or not.

Attribute	Level 1	Level 2	Level 3	Level 4
1. Balcony	No	Yes	-	-
2. Price (monthly Argentine pesos)	$100.000	$150.000	$200.000	-
3. Rooms	1	2	3	-
4. Geographical Area	West GBA	South GBA	North GBA	CABA

Survey design

The requested questionnaire was provided through the Google Forms platform, and the profiles were created following the example of orthogonal experimental designs with 4 attributes having 2, 3, 3, and 4 levels, respectively.

Perfil	Atributo 1 2 niveles	Atributo 2 3 niveles	Atributo 3 3 niveles	Atributo 4 4 niveles
1	2	3	3	4
2	2	3	1	2
3	2	3	1	1
4	2	2	3	2
5	2	2	2	1
6	2	2	1	4
7	2	2	1	3
8	2	1	3	2
9	2	1	2	4
10	2	1	2	3
11	1	3	3	3
12	1	3	2	4
13	1	3	2	2
14	1	2	3	1
15	1	2	2	2
16	1	2	1	3
17	1	1	3	4
18	1	1	1	2
19	1	1	1	1

First Section – Demographical Data

1. What is your age? (Short text response that only accepts numerical values)
2. Do you currently have a paid job? If yes, what is your work arrangement? (Multiple choice)
   - Yes, I work in-person
   - Yes, I work in a hybrid manner
   - Yes, I work remotely
   - No, I don't have a paid job currently
3. In which area do you currently reside?
   - CABA (Autonomous City of Buenos Aires)
   - GBA Sur (Greater Buenos Aires South)
   - GBA Norte (Greater Buenos Aires North)
   - GBA Oeste (Greater Buenos Aires West)
   - Others

The purpose of these questions was to analyze the results based on potential patterns with demographic data. However, this analysis is beyond the scope of this study.

Second Section – Apartment Rental Ratings

Upon reaching section 2, the survey participant will encounter the following text:

"In this section, you'll be presented with 19 options for renting different apartments. You'll need to rate them on a scale from 1 to 9, where 1 represents a terrible rental offer, and 9 represents an excellent rental offer.

The rentals will have 4 attributes that vary for each option:

Balcony: Yes or No. Indicates whether the apartment has a balcony or not.

Monthly rent: 100,000, 150,000, or 200,000 Argentine pesos per month.

Rooms: 1, 2, or 3. Represents the number of spaces in the apartment: 1 for a studio apartment with combined bedroom and living room, 2 for an apartment with separate bedroom and living room, and 3 for an apartment with 2 bedrooms and a living room.

Geographical area: GBA Oeste, GBA Sur, GBA Norte, CABA. Represents the area where the apartment is located."

Then, subsequently, they will encounter a description of the proposed combination and a scale from 1 to 9, where 1 represents a terrible offer and 9 an excellent offer. Here, the survey participant can rate their perception of each combination. Below is an example of how the respondents viewed each question.

The survey participant will encounter this question format repeated with the following 19 combinations, constructed based on the example of the orthogonal experimental design mentioned earlier.

Apartment Profile	Balcony	Price	Rooms	Geographical Area
1	Yes	$200 k	3	CABA
2	Yes	$200 k	1	South GBA
3	Yes	$200 k	1	West GBA
4	Yes	$150 k	3	South GBA
5	Yes	$150 k	2	North GBA
6	Yes	$150 k	1	CABA
7	Yes	$150 k	1	North GBA
8	Yes	$100 k	3	South GBA
9	Yes	$100 k	2	CABA
10	Yes	$100 k	2	North GBA
11	No	$200 k	3	North GBA
12	No	$200 k	2	CABA
13	No	$200 k	2	South GBA
14	No	$150 k	3	West GBA
15	No	$150 k	2	South GBA
16	No	$150 k	1	North GBA
17	No	$100 k	3	CABA
18	No	$100 k	1	West GBA
19	No	$100 k	1	North GBA

II.   Data Collecting.

With the aim of data collection, the survey launched on the 16th of September 2023 and concluded two days later, on the 18th of September 2023. During this period, 15 responses from different respondents were collected.

III.   Análisis de datos.

Regressions

For the linear regression analysis, the statsmodels package in Python was used. A linear regression was conducted for each participant. Throughout this third section of the report, we will evaluate the results of the regressions.

As a general assessment of the regressions, 57% of the 135 variables (one per level of each attribute for each participant) turned out to be statistically significant at a 5% confidence level, indicating a significant effect in most attributes. Additionally, the average R^2 of the 15 regressions was 0.72, suggesting a good overall fit for most regressions.

Below, we present an average calculated from the coefficients of each variable across the 15 participants.

The coefficients are compared against an intercept containing the variables Rooms[T.1], Balcony[T.No], Price[T.$100,000], and Geographical area[T.CABA]. Thus, the coefficient of the intercept represents the average score of participants

for a studio apartment in CABA, without a balcony, priced at $100,000 per month. Therefore, for example, changing from a studio to a 2-bedroom apartment while keeping everything else constant would increase the apartment's score by 1.76 (on average, this value varies among each participant).

Variable	Average Coefficient
Rooms[T.2]	1.76
Rooms[T.3]	3.11
Balcony[T.Yes]	0.89
Intercept	5.15
Price[T.$150.000]	-1.15
Price[T.$200.000]	-2.42
G.Area[T.North_GBA]	-0.07
G.Area[T.West_GBA]	-1.38
G.Area[T.South_GBA]	-1.21

Relative Importance of each attribute
The relative importance of each attribute of each respondent were the following:

Respondent	Rooms	Balcony	Price	G. Area
1	0,39	0,14	0,28	0,18
2	0,39	0,11	0,36	0,14
3	0,43	0,09	0,33	0,15
4	0,42	0,17	0,19	0,22
5	0,36	0,14	0,28	0,22
6	0,45	0,27	0,07	0,21
7	0,33	0,04	0,33	0,31
8	0,34	0,04	0,39	0,23
9	0,27	0,02	0,49	0,22
10	0,26	0,17	0,43	0,15
11	0,55	0,13	0,18	0,15
12	0,37	0,04	0,31	0,28
13	0,14	0,03	0,30	0,54

| 14	0,40	0,02	0,15	0,43
15	0,24	0,42	0,20	0,14

Here are some insights extracted from the results regarding the importance of each attribute:

- The most important attribute was the number of rooms for 60% of the respondents. The remaining 40% distributed their importance among price (20%), geographical area of the property (13%), and balcony availability (7%).
- The least important attribute was whether the property had a balcony or not for 80% of the respondents. 13% indicated that the geographical area was the least important attribute, and only 7% said the same about the price. None of the respondents considered the number of rooms as the least important attribute.
- Assessing the average importance across all respondents, the most important attribute was the number of rooms (0.35), followed by price (0.28), geographical area (0.23), and balcony availability (0.12), respectively.

<u>Coefficients related to the price for each respondent</u>

Considering $100,000 as the zero coefficient, as it's the level of the attribute contained within the intercept, the following graph was obtained for the levels of $150,000 and $200,000:
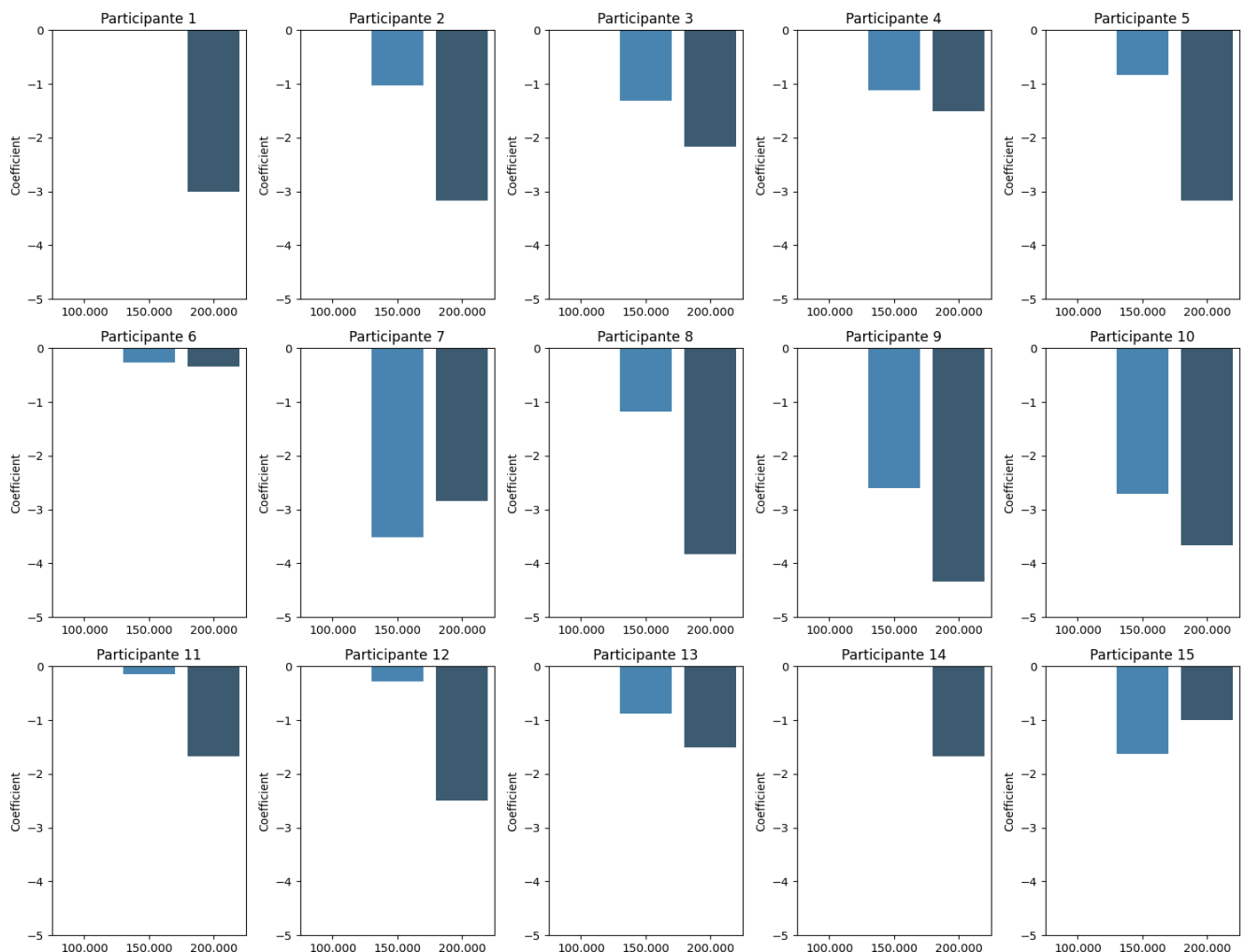
In this graph, it's interesting to evaluate the behavior of the respondents regarding the price.

Some participants, like 1, 11, 12, and 14, seem to be less affected by the change from $100,000 to $150,000, but they appear to be less tolerant of paying $200,000 monthly. Following this premise, for this segment that seems to behave similarly, at least concerning the price, a charge of $150,000 might not negatively affect their perception.

Other participants, like 9, 10, and 7, place significant importance on the price, and the best decision might be to offer them the cheapest apartment possible since price increases have a strong negative impact on their perception of the offer.

Finally, participants 15 and 6 showed that the price was one of their less important attributes. This segment might be willing to pay the highest price as long as the apartment meets their expectations in the other attributes. Therefore, the management strategy should aim to offer them the most suitable apartment to extract the highest possible value from them.

Willingness to pay for the most important attribute
For each participant, the most important attribute was selected, and the willingness to pay for each level of that attribute was calculated, resulting in the following outcomes:

Participant	Most Important Attribute	Attribute level	Willingness to pay ($)
1	Ambientes	Ambientes[T.3]	141967
1	Ambientes	Ambientes[T.2]	69744,74
2	Ambientes	Ambientes[T.3]	105947,7
2	Ambientes	Ambientes[T.2]	48052,99
3	Ambientes	Ambientes[T.3]	129521,8
3	Ambientes	Ambientes[T.2]	75675,68
4	Ambientes	Ambientes[T.3]	218825,1
4	Ambientes	Ambientes[T.2]	129936,2
5	Ambientes	Ambientes[T.3]	126475,8
5	Ambientes	Ambientes[T.2]	79107,4
6	Ambientes	Ambientes[T.3]	681165,5
6	Ambientes	Ambientes[T.2]	431165,5

7	Ambientes	Ambientes[T.3]	123837,4
7	Ambientes	Ambientes[T.2]	59131,56
8	Ambientes	Ambientes[T.3]	87441,25
8	Ambientes	Ambientes[T.2]	30919,51
9	Ambientes	Ambientes[T.3]	56035,6
9	Ambientes	Ambientes[T.2]	32958,68
10	Ambientes	Ambientes[T.3]	60089,07
10	Ambientes	Ambientes[T.2]	14634,52
11	Ambientes	Ambientes[T.3]	308243,2
11	Ambientes	Ambientes[T.2]	238243,2
12	Ambientes	Ambientes[T.3]	117882,9
12	Ambientes	Ambientes[T.2]	64549,55
13	Zona	Zona[T.Gba_Norte]	-47409,9
13	Zona	Zona[T.Gba_Sur]	-161261
13	Zona	Zona[T.Gba_Oeste]	-180743
14	Zona	Zona[T.Gba_Norte]	173209,5
14	Zona	Zona[T.Gba_Sur]	-122432
14	Zona	Zona[T.Gba_Oeste]	-126791
15	Balcón	Balcón[T.Si]	340540,5

Moving to a general analysis of the presented table, respondents whose most important attribute was the number of rooms were willing to pay an average of $106,000 extra for a 2-bedroom apartment and $179,000 extra for a 3-bedroom apartment.

In the case of respondents for whom the geographical area was the most important attribute, they shared a common pattern. Both would forego approximately $150,000 to move from CABA to the South or West of Greater Buenos Aires. However, they did not show the same behavior regarding the North area. One respondent would forego around $47,000 monthly, while another would pay approximately $63,000 extra to live in the North area

Preferences Based Segmentation

KMeans algorithm was employed for segmentation, commonly used in clustering exercises, using the relative importance of each attribute presented in section B as variables for the model. By utilizing the elbow method, 4 was determined as the optimal number of clusters. After training the model and assigning each participant to a cluster, a graph was generated with the relative importance of each segment, highly useful for understanding the differences between them.

Importancia de atributos por cluster
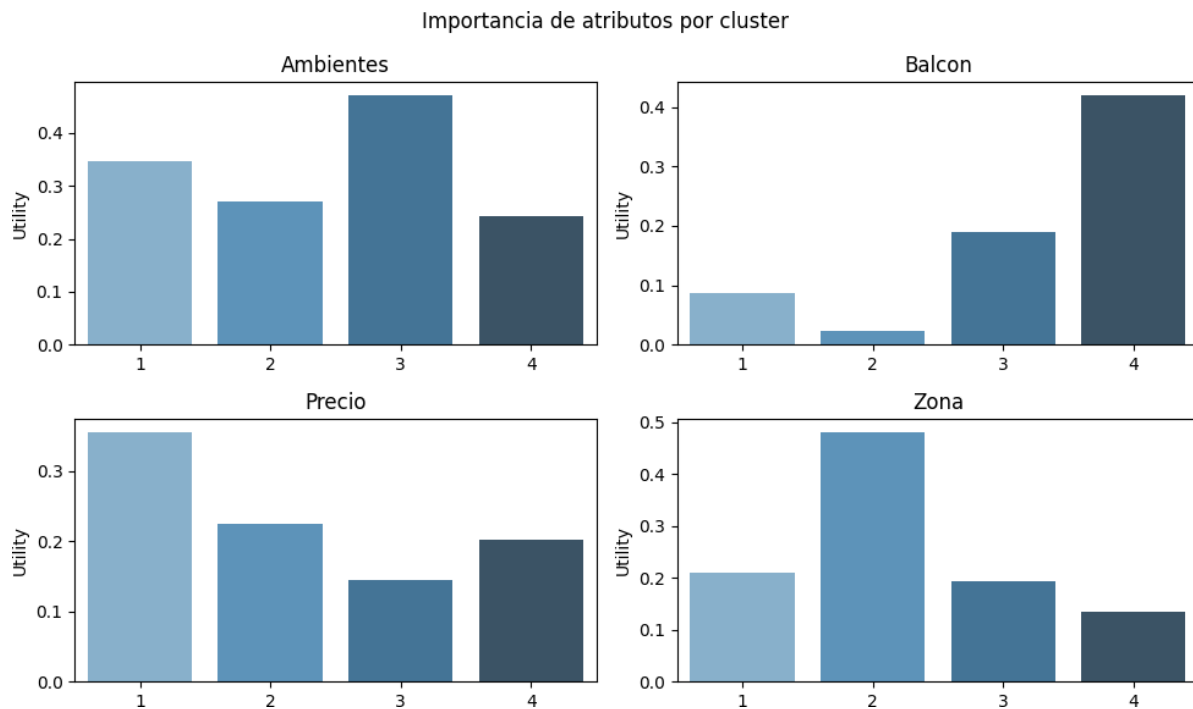
The first segment is characterized by placing strong importance on the number of rooms and the apartment's price, without neglecting any other attributes. So, a smart offer for this segment would be a 2-3 room apartment at a good price (100-150k), while considering the area, and recognizing that a balcony would add significant value.

The second segment highly values the apartment's area and doesn't prioritize whether it has a balcony. Therefore, it's important to offer an apartment in CABA, which was the most preferred area for most respondents, without a balcony, and with a reasonable price-to-room ratio.

The third segment is defined by its relative importance regarding the number of rooms in the apartment. An offer appealing to this segment would involve a 3-room apartment. While other attributes matter to participants in this segment, they appear to be less of a priority.

The fourth and final segment emphasizes whether the apartment has a balcony. These individuals likely enjoy connecting with the outdoors, considering it essential for the apartment to have a balcony. Similar to the previous segment, no attribute is neglected, but it's crucial for the apartment offer to include a balcony.

Two Apartment Rental Profiles and its market share

Two apartment profiles were generated with the following characteristics to calculate the market share of each one:

Attribute	Apartment 1 (Enterprise X)	Apartment 2 (Enterprise Y)
Rooms	2	3
Price	$150.000 monthly	$150.000 monthly
Geographical Area	CABA	North GBA
Balcony	Yes	No

Based on these product profiles, the utility assigned to each product by each participant was calculated. Following a rational logic, it was assumed that each participant would choose the product that provided them with the highest utility. Following this approach, 6 respondents chose apartment 1, and 9 chose apartment 2. Therefore, based on the results, my estimation is that Company X would have a 40% market share, and Company Y would have the remaining 60%. As a final step, I attempted to relate the choice between the two apartments to the segments from the previous point. However, this should be approached cautiously due to the limitations of the few responses in the study. Nonetheless, some patterns can be observed:

- The segment 1 shows a higher preference for apartment 2, aligning with their preference for the number of rooms as mentioned in their description in the previous point.
- The decision of segment 4 is strongly influenced by the fact that apartment 1 has a balcony (this segment comprises only one participant; it would be interesting to see if this repeats in a larger-scale study)

Puntaje promedio por cluster