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# SATISFACTION AND DISSATISFACTION ON UBER AND TAXI SERVICES

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**Abstract:**
The purpose of this article was to identify and to measure what are the most relevant variables that can impact the level of (dis)satisfaction on users of the service transportation of Taxi and Uber in the city of Rio de Janeiro – Brazil. Therefore, tried to identify through the discriminant analysis, the determinant variables to the users' choices of these services. The target audience of this research were individuals who had already used, at least once, some of these services, specifically in the city of Rio de Janeiro, with the intention to not having significant discrepancies in relation to the different realities of the several municipalities that make up the State of Rio de Janeiro. The three most relevant variables in the discriminant function related to the dissatisfaction on Taxi's users in this sample were (i) travel prices, (ii) service request facility and (iii) comfort. In the other hand, the three most relevant variables in the discriminant function related to the satisfaction on Uber's service were (i) service request facility, (ii) forms of payment and (iii) comfort. The great contribution of this work was given by the fact to sheds light on the discussion about the satisfaction of the users of individual transportation services, specifically on Uber's and Taxi's users in the city of Rio de Janeiro (Brazil), and leave of the common sense on this subject, which generally permeates the discussion of the regulation of these services.

**Keywords:** satisfaction, taxi, uber.

## 1. Introduction

Nowadays, many countries have their economies based on services and in Brazil this situation is not different. According to data published in 2017 by the Brazilian Institute of Geography and Statistics (IBGE), despite the successive falls in services sector has been experiencing in the country, due to the economic crisis and the high unemployment rates, this sector has the greatest weight in the Brazilian's economy, accounting for approximately 70% of the Gross Domestic Product (GDP) of the country. Among the activities related to the services sector are the transportation sector, which in 2017 was one of the few segments that presented growth and contributed to the reduction of the rate of decline on service sector in Brazil (IBGE, 2017).

Among the various modes of transportation available in Brazil, the segment of individual passenger transport has recently undergone drastic changes due to the entry of new competitors - the same phenomena can be seen in another countries (Schor, 2016; Rayle, Chan, Cevero & Shaheen, 2016; Rasheed, Mazhar & Shahid, 2018; Mahapatra & Telukoti, 2018). The individual passenger transport sector, which was formerly monopolized by Taxis and undergoing intense regulation, has been going through a series of transformations in the last few years, and it has experienced a new market reality, with intense competition, pressure for quality, improvement of services provided, more affordable prices and constant search of customer satisfaction. The biggest part of these changes was driven by the creation of applications for the provision of paid carriage services, more specifically with the vertiginous growth and performance of Uber service in Brazil.

By changing the dynamics of a, up until now, stagnant market such as the individual transport of passengers provided by Taxi, the Uber has generated a series of discussions, judicial disputes about the legality of services, lack of regulation for this new entrant, as well as several other critics from people connected or benefited by Taxi industry, who feels hurt by Uber's performance in Brazil (Esteves, 2015). The same phenomena could be identified in USA how presents by Schor (2016). However, the goal in this investigation was to discuss relevant

variables associated to consumer's perception in the quality services on taxi and ridesourcing services.

This investigation was not intended to adopt a favorable or unfavorable position neither on the performance of Uber in Rio de Janeiro (Brazil) nor to the common Taxi. Our goal here is to highlight some variables presented by others researchers whose investigated Taxi or Uber's satisfaction in Marketing field. Thus, the main objective of this research was to identify and to measure what are the most relevant variables what can impact Taxi and Uber's Dissatisfaction and Taxi and Uber's Satisfaction. Next section discusses some variables what may impact consumer satisfaction on Taxi or Uber's services, on the context of Rio de Janeiro (RJ) city not on the context of Rio de Janeiro (RJ) state.

## 2. Ridesourcing and Taxi Transportation: a Consumer's Perception of Service Quality

Consumers seem more worried about quality of services than before in different ways. If in the past quality of service depended on attributes directly related just to a specifically service, nowadays, they wouldn't consider just internal characteristics related to this service, but others peripheral characteristic too. For example, corporate social responsibility is a very important variable whose may impact on consumer buying decision (Mohr, Webb & Harris, 2001) or on consumer boycott decision (Cruz, 2017). Even the service achieves good individual perception of quality, there are other variables who consumers may consider on your personal decision such as sustainability (O'Rourke & Ringer, 2015), LGBTIQ+ cause (Taylor, 2014), sexual harassment (Griffith, Esch & Trittenbach, 2018) or consumer guilt (Silva & Martins, 2017) as well. Thus, the quality of service is not just to offer a regular service - it is a complex experience whose involves many variables (Walkers, 1995).

Sharing economy has been growing through the last years in different countries, and in many ideas that changed some industries (Cannon & Summers, 2014; Kumar, Lahiri & Dogan, 2018) such as apartment rentals (Airbnb), tourist accommodation (Couchsurfing) and the most famous: ridesourcing (Uber). This new kind of exchange can be called Collaborative Consumption (CC) - a triangle of actors among service provider, customer and platform provider (Benoit, Baker, Bolton, Gruber & Kandampully, 2017).

Schor (2016) informs that **Uber** and **Airbnb** platforms attracted a great deal of attention among economists or local government because there were no rules about these kinds of services based on sharing economy in lot of countries due it is a new way to offer services. Rauch and Schleicher (2015) discuss that some stakeholders in different industries have pushed for regulations stifling or banning new sharing economy entrants.

First of all, in this new sharing economy context, we understand that is important to define ridesourcing in this paper in opposite to **taxi's industry.** Thus, ridesourcing is a service whose drivers operate for profits and it is distinguished from traditional taxis due ridesourcing use smartphone technologies (Rayle *et al.,* 2016; Steven, 2016). **Uber, Lyft** and **Cabfy** are some examples of these new kinds of service in the segment of individual passenger transport. However, this definition does not be completely used in Brazilian and Pakistan context because there are ridesourcing applicatives these are used by both: private cars and taxis (the **99 Taxi** applicative in Brazil and the **A-Taxi** in Pakistan).

In **Uber** and **Taxi's industry**, Waalsten (2015) presents relevant results in American cities as New York and Chicago to discuss how Uber is changing taxis. For example, in New York, complaints per trip about taxis declined due Uber's increasing popularity. It may sound strange but Uber's drivers tend to be politer and pay more attention to passengers than Taxi's drivers; or despite Waalsten's argument, in Chicago Uber's growth is associated with particular complaints about taxis such as credit card machines, rudeness, talking on cell phones, air

conditioning and heating. These results in Waalsten's investigation show us in Chicago and New York cities that taxi industry responds to new competition improving quality.

Some variables have to be understood when we are investigating Uber and Taxi transportation. Rayle, Shaheen, Chan and Cevero (2015) presented 11 reasons present buy consumers to get Uber transportation in San Francisco (USA). In order to relevance, they are: (1) ease of payment, (2) short wait time, (3) fastest way to get there, (4) easy to call car, (5) didn't want to drive after drink, (6) don't need to park, (7) reliable, (8) comfort/safety, (9) cost - cheaper than alternatives, (10) no public transportation and (11) could not get taxi. The two latest items (10 and 11) could be singular to San Francisco city as inform the author's study, however we understand those items in Rio de Janeiro city as well because Rio de Janeiro's violence and public transportation context.

An interesting argument is presented by Rayle *et al*. (2016) concerned to quality of service on taxis. To the authors, it is not possible to choose on streets some taxi based on its previous quality service information. Thus, there is a lack of information when some consumer decides to get this kind of service on streets what can result in poor quality.

Due research on the use of ridesourcing is very limited (Rayle *et al*., 2016) in this paper we chosen 10 items mixing Uber and taxi characteristics. Box 1 shows all variables whose we decided to understand in our discriminant function models in this investigation.

**Box 1 -** Variables related to Uber and Taxi Consumer Satisfaction literature

| Variables | Literature related to |
|---|---|
| **Travel Price (TP)** | Rayle *et al.* (2015) and Rayle *et al*. (2016) discuss these two variables in their papers. Rasheed, Mazhar and Shahid (2018) presented how Travel Price impacted on customer satisfaction. |
| **Forms of Payment (FP)** | |
| **Comfort (CF)** | Waalsten (2015) specifically air conditioning and heating. |
| **Reliability and Credibility (RC)** | Rayle *et al.* (2016) discussed the opposite of this when they highlight that consumers could not have previous perception of taxi's quality on streets before using its. Asmi, Zhou, He and Han (2016) conclude that trust is a strong predictor of satisfaction in Uber and Taxi services in China. |
| **Safety (SG)** | Rayle *et al*. (2015) and Rasheed, Mazhar and Shahid (2018) presented customer perception of security even in Taxis and Uber. To Mastrorillo (2016), Uber's inadequate screening methods have put customers at risk of physical violence. In Chinese context, Asmi *et al*. (2016) highlighted security related to applicative. Skok and Baker (2018) identified safety as an important variable in a comparison between Taxi and Uber in London. |
| **Vehicle Conservation (VC)** | Rasheed, Mazhar and Shahid (2018) concluded that this variable is relevant to impact Taxi and Uber consumer perception of satisfaction. |
| **Service Request Facility (RF)** | Easy to call car' was the expression used by Rayle *et al*. (2015) to present what we named RF. |
| **Waiting Time (WT)** | Rayle *et al.* (2016) and Rayle *et al*. (2015) discuss how waiting time is an important variable to understand consumers decision to use Uber. |
| **Driver Cordiality (DC)** | The opposite of this, related to complains, was presented by Waalsten (2015) to discuss rudeness of taxi's drivers. |
| **Driver's Domain (DD)** | Rasheed, Mazhar and Shahid (2018) called Driver's behavior in their investigation. Mahapatra and Telukoti (2018) identified that unprofessional driver behavior was not a problem to consumer in that sample. |

*Note.* This table was constructed to describe, in a summarized way, the variables used in this work, based on the authors mentioned above. The complete references of this papers were mentioned at the end of this article on "references".

So, to this paper was proposed four hypotheses according to satisfaction and dissatisfaction of Uber and Taxi users.

- ✓ Uber - **$H_1$**: Travel Price (TP) is the most important variable whose discriminates Uber satisfaction service. **$H_2$**: Driver Cordiality (DC) is the most important variable whose discriminates Uber dissatisfaction service.

- ✓ Taxi - **$H_3$**: Service Request Facility (RF) is the most important variable whose discriminates Taxi satisfaction service. **$H_4$**: Travel Price (TP) is the most important variable whose discriminates Taxi dissatisfaction service.

## 3. Method

### *3.1 Population and research sample*

Related to the population and the sample of this study, the population was constituted by all users of the individual transport of passengers that have already used, at least once in some opportunity, the services of Taxi and Uber in the city of Rio de Janeiro. However, due to the unknown size of this population, it could be considered as infinite from the statistical point of view. Thus, the non-probabilistic sampling technique was used to convenience type, considering the responses obtained were according to the most accessible and available sample units to participate in the survey, since this type of sampling has greater economic viability. It's important to notice that in Rio de Janeiro, there are two situations that restrain researchers from performing a simple random sample: (1) not funds to support this research; (2) the large number of risk areas, where uber cannot get in to offer the service. Thus, there is no possibility of performing a probabilistic sample in the studied context.

### *3.2 Elaboration of the questionnaire*

Initially, a pre-test was carried out to evaluate the content, layout and difficulties encountered by participants on the time of filling out the questionnaire. This first step was applied to a sample of 10 people. According to Malhotra (2012, p. 256) "the pre-test refers to the test of the questionnaire in a small sample of respondents, with the objective to identifying and eliminating potential problems".

The questionnaire was made available and disseminated **online,** it was composed by 28 questions, including those directly related to the measurement of the general satisfaction of users and the attributes, tangible and intangible of these services, and which had a scale of five-points Likert's type, varying as: 1 - very unsatisfied; 2 - unsatisfied; 3 - normal; 4 - satisfied; 5 - very satisfied. The use of the Likert-type scale can be justified to increase the number of possible points of choice, thus allowing a better capture of the actual situation of the respondent (Kerlinger, 1980; Zambaldi, Costa & Ponchio, 2014). The questionnaire had closed questions to identify frequency of use, purpose of use, socio-demographic data and others.

### *3.3 Data analysis technique*

To perform the data analysis of this research, it was opted to use the Multiple Discriminant Analysis (MDA), which according to Altman (1968), MDA is a statistical technique mainly used to classify, categorize or predict problems in which the dependent variable appears qualitatively, in other words, considered as a categorical or discrete variable (*e.g*: male or female, solvent or insolvent, good or bad, etc.). Therefore, the first step in using this technique is to establish explicit group classifications, which may be two or more.

According to the literature on MDA, the English statistician Karl Pearson, who in his works showed the first ideas about this statistical tool, is a precursor of this technique. However,

it was through the 1936 work of the "**the use of multiple measurements in taxonomic problems**", from the English statistician, Ronald Aylmer Fisher, the tool of Discriminant Analysis spread throughout the academic world (Tatsuoka & Tiedeman, 1954). So, Fisher (1936) states that "when two or more populations are measured in various traits ($x_1$, ..., $x_s$), special interest will be connected to certain linear functions of the measures by which populations are best discriminated against".

Hair, Anderson, Tathan and Black (2009), indicate a possible way to explain the model of discriminant analysis mathematically through the following equation:

$$Z_{jk} = \alpha + w_1 x_{1k} + \cdots + w_n x_{nk} \quad (1)$$

**Where:**
**$Z_{jk}$** is the discriminant score (dependent variable) of the function *j* to the object *k*;
**α** is the function intercept when all $X_{ik} = 0$;
**$W_i$** is the discriminant weight for independent variable *i*;
**$X_{ik}$** value of the independent variable *i* to the object *k*.

Regarding this present research, the dependent variable used is about a multicomponent qualitative nature and represents the satisfaction level of the users', while the independent variables are related to attributes, tangible and intangible, of the service rendered, that directly affect the degree of customers' satisfaction about the services provided by Taxi and Uber.

## 4. Analysis of Results

This topic sought to analyze the results obtained in tests applied in discriminant analysis. Here we present three distinct groups to understand consumer perception of quality on Taxi and Uber's services, they are: (i) a certain degree of dissatisfaction; (ii) indifference; (iii) a certain degree of satisfaction.

These three groups appeared through the five-point Likert's scale that was applied on the research questionnaire, so the group that presented **a certain degree of dissatisfaction** was composed by items 1 (very dissatisfied) and 2 (dissatisfied); already which presented **indifference**, was composed by item 3 (normal); and the last group, which presented **a certain degree of satisfaction**, was composed by items 4 (satisfied) and 5 (very satisfied). And the mean interval of the groups was: 1 to 2.99 (1st group = 0); 3 to 3.99 (2nd group = 1); and 4 to 5 (3rd group = 2). Within the marketing literature, there is no exact definition of the number of groups and/or ranges of averages applied in each group, which is known that satisfaction studies tend to consider perceptions of satisfaction and dissatisfaction, however, as in this work, the number of people that made up the indifferent group was a significant part of the sample, especially for users of the common Taxi service, so, instead to exclude them, and thus compromising the sample of the research, it was opted to work with an additional group, including among the two groups more common in the area research. Woodruff, Cadotte and Jenkins (1983), Hart and Johnson (1999) recognize that there is a point of neutrality within the customer satisfaction and dissatisfaction continuum and call it a "zone of indifference".

**Table 1 -** Tests of Equality of Group Means

| VI | Wilks' Lambda | F | df1 | df2 | Sig. |
|---|---|---|---|---|---|
| **TP** | 0,419 / 0,746 | 105,999 / 25,652 | 2 | 153 / 151 | 0,000 |
| **FP** | 0,404 / 0,729 | 112,681 / 28,004 | 2 | 153 / 151 | 0,000 |
| **CF** | 0,350 / 0,737 | 142,032 / 26,949 | 2 | 153 / 151 | 0,000 |
| **RC** | 0,462 / 0,571 | 89,018 / 56,815 | 2 | 153 / 151 | 0,000 |
| **SG** | 0,535 / 0,604 | 66,476 / 49,500 | 2 | 153 / 151 | 0,000 |

| | | | | | |
|---|---|---|---|---|---|
| **VC** | 0,356 / 0,770 | 138,490 / 22,586 | 2 | 153 / 151 | 0,000 |
| **RF** | 0,355 / 0,675 | 139,257 / 36,278 | 2 | 153 / 151 | 0,000 |
| **WT** | 0,400 / 0,711 | 114,956 / 30,695 | 2 | 153 / 151 | 0,000 |
| **DC** | 0,377 / 0,601 | 126,634 / 50,153 | 2 | 153 / 151 | 0,000 |
| **DD** | 0,522 / 0,742 | 70,161 / 26,222 | 2 | 153 / 151 | 0,000 |

*Note.* This table shows the results obtained on the two discriminant functions tested on this paper (to Uber and to Taxi users).

Table 1 presents the means tests of the groups to each explanatory variable, related to: Travel Price (TP), Forms of Payment (FP), Comfort (CF), Reliability and Credibility (RC), Safety (SG), Vehicle Conservation (VC), Service Request Facility (RF), Waiting Time (WT), Driver Cordiality (DC), and Driver's Domain (DD). It also identified the variables that were the best discriminants of levels of satisfaction, in relation to the means of the groups (those with a certain degree of dissatisfaction, the indifferent and those with a certain degree of satisfaction).

With Table 1 divided among the results found in Uber and Taxi users' tests, the results on the left side refer to Uber and, on the right, to Taxi. Those that presented only one result were because there was no difference between the values found in the results on the two tests.

This first test seeks to present the equality of means of the groups, and to identify which variable is the best discriminator (means of the groups) to the groups studied. In the first case (UBER), it was identified the variable CF (Comfort) was the one that obtained the best discrimination power between the means of the groups, due to the low value found in **Wilk's Lambda** results, otherwise the variable had the worst power of discrimination was the SG (Safety). On the second case (TAXI), it was identified the variable RC (Reliability and Credibility) was the one that presented the best discriminating power between the means of the groups, otherwise the variable that had the worst discriminating power was VC (Vehicle Conservation).

According to Bartlett, Simonite, Westcoot and Taylor (2000), **Wilks' Lambda** is a test statistic used to test the existence of differences between the means of the groups of individuals identified in a combination of dependent variables. Their results vary on a scale of 0 to 1, with values close to zero, those with the best discrimination of the groups, in other words, they indicate a strong difference between the means. Table 1 also presents results from the F-ANOVA test, which helps to evaluate the previous test, demonstrating that the two variables that presented the lowest **Wilks' Lambda** values obtained a satisfactory level of significance (*sig.*<0.05), which as standardized by Bartlett (1950), the value of 0.05 is considered statistically significant, it means, $p<0.05$ or *sig.*<0.05 (*p-test* or *sig.*).

After that, we decided to do the "*Box's M test*", where the null hypothesis for this test was the covariance matrices observed to the dependent variables were equal between the groups. In other words, a non-significant test result (sig.>0.05) would indicate equal covariance matrices.

The British statistician George Edward Pelham Box, in his article published in the **biometrika** magazine in December 1949 edition titled as "**A General Distribution Theory for a Class of Likelihood Criteria**", performed different tests to confirm what was later known as "**Box's M test**", which sought to determine if two or more covariance matrices were equal, assuming the null hypothesis was of equality of covariance matrices (Box, 1949).

In this case, both the results found to Uber and Taxi indicated a violation on homogeneity assumption of covariance matrices. One possible explanation for this has been the fact of this test be extremely sensitive to deviations from normality and has little power to small samples, which corroborates with what is discussed in the literature of the subject, that although each of the variables has normal distribution, it is not guaranteed that there will be multivariate normality. Therefore, two possible solutions normally indicated to problems like this, would be: (i) the increase of sample size, as proposed by Corrar, Paulo and Dias Filho (2014), after

presenting the result of their example on the Box's M test; or (ii) a decrease in the level of significance, as Hahs-Vaughn (2017) suggests that researchers using the Box's M test as evidence of homogeneity may want to use a more flexible level of significance, such as 0.001, to test; but in this specific case, the results would not change, since in both cases the level of significance was 0.000, rejecting the null hypothesis.

However, it was decided to continue the analysis of the results to verify the performance of the obtained function, since to date, indicates that the statistical violation found in this test (Box's M), is not making the study unfeasible.

Table 2 presented the Wilks' Lambda values, with the first line presenting the test of significance of the two functions on the same time, and the second line presenting the test of significance of function two separately.

**Table 2 -** Wilks' Lambda

| Test of Function(s) | Wilks' Lambda | Chi-square | df | Sig. |
|---|---|---|---|---|
| 1 through 2 | 0,149 / 0,321 | 282,525 / 166,653 | 20 | 0,000 / 0,000 |
| 2 | 0,863 / 0,908 | 21,874 / 14,137 | 9 | 0,009 / 0,118 |

*Note.* These results were found based on the database of this paper.

The results found in the tests of significance of the two functions together, showed good results, in both cases (sig. 0.000<0.050), indicating the two functions together were able to differentiate the groups. In the test of significance of function two separately, the results differed a little, and the result was found to Uber (sig. 0.009<0.050), indicating the function two could classify the cases when considered alone, and in the case to Taxi, the result was not good (sig.0,118>0.050), thus, function two would not be able to classify cases when considered alone. Regarding the reading of the **Wilks' Lambda test**, as the level of significance, the interpretation was the same as the one adopted in the beginning, values closer to zero, would have a significant difference between the means of the groups, indicating a good discrimination power function; as perceived in the results above, the closest values of zero were found in the first discriminant function.

The coefficients to the construction of the two discriminant functions were important so the observations could be separated into groups. These statistics had relevance to indicate if the discriminant functions selected reflected the differences between the groups. In this way, it was possible to structure each non-standardized canonical discriminant function, considering the order (Uber and Taxi), as shown below:

$$Z_{1u} = -9{,}424 + 0{,}178\,(\mathrm{TP}) + 0{,}321\,(\mathrm{FP}) + 0{,}384\,(\mathrm{CF}) + 0{,}131\,(\mathrm{RC}) + 0{,}088\,(\mathrm{SG}) + 0{,}074\,(\mathrm{VC}) + 0{,}472\,(\mathrm{RF}) + 0{,}232\,(\mathrm{WT}) + 0{,}315\,(\mathrm{DC}) + 0{,}267\,(\mathrm{DD}) \quad \textbf{(2)}$$

$$Z_{2u} = 0{,}205 - 0{,}599\,(\mathrm{TP}) - 0{,}585\,(\mathrm{FP}) - 0{,}110\,(\mathrm{CF}) + 0{,}276\,(\mathrm{RC}) + 0{,}563\,(\mathrm{SG}) + 0{,}334\,(\mathrm{VC}) - 0{,}135\,(\mathrm{RF}) - 0{,}159\,(\mathrm{WT}) + 0{,}221\,(\mathrm{DC}) + 0{,}366\,(\mathrm{DD}) \quad \textbf{(3)}$$

$$Z_{1t} = -5{,}865 + 0{,}380\,(\mathrm{TP}) + 0{,}264\,(\mathrm{FP}) + 0{,}063\,(\mathrm{CF}) + 0{,}341\,(\mathrm{RC}) + 0{,}306\,(\mathrm{SG}) - 0{,}100\,(\mathrm{VC}) + 0{,}470\,(\mathrm{RF}) - 0{,}080\,(\mathrm{WT}) + 0{,}427\,(\mathrm{DC}) + 0{,}173\,(\mathrm{DD}) \quad \textbf{(4)}$$

$$Z_{2t} = 0{,}109 + 0{,}430\,(\mathrm{TP}) + 0{,}637\,(\mathrm{FP}) - 0{,}672\,(\mathrm{CF}) - 0{,}407\,(\mathrm{RC}) - 0{,}007\,(\mathrm{SG}) + 0{,}149\,(\mathrm{VC}) + 0{,}018\,(\mathrm{RF}) - 0{,}534\,(\mathrm{WT}) + 0{,}215\,(\mathrm{DC}) + 0{,}374\,(\mathrm{DD}) \quad \textbf{(5)}$$

After that, it was identified the contribution of each variable to each discriminant function and these variables with the highest correlation power with the first discriminant function in Uber's case were CF, RF, VC, DC, WT and RC. In the case of the second function of Uber, they were: FP, TP, DD and SG. In the case of the first discriminant function of Taxi's case, they were: RF, VC, DC, RC, FP, DD and SG. And in the second function of Taxi, they were: CF, WT and TP.

In the case of the centroids of functions 1 and 2 of Uber's case, they were divided as follows: function 1 = -5.161, -0.567, 1.602; function 2 = 0.489, -0.517, 0.243. In Taxi's case, they were divided into: function 1 = -0.885, 1.419, 4.167; function 2 = 0.086, -0.349, 1.221. Recalling these values follow the following order of groups: 0 = some degree of dissatisfaction; 1 = indifferent; and 2 = a certain degree of satisfaction. The centroids of the groups help in the process of classifying the sample and to calculate the cut-off point, which serves to classify the cases by the canonical discriminant functions.

In Table 3, the coefficients of the classification functions, also called Fisher's linear discriminant functions, could be checked, one of the most common functions generated by the statistical programs, to define the classification of each case in a given group.

**Table 3 -** Classification Function Coefficients

| Variables | Groups | | |
|---|---|---|---|
| | Certain degree of dissatisfaction | Indifferent | Certain degree of satisfaction |
| TP | 1,071 / 2,697 | 2,491 / 3,386 | 2,422 / 5,106 |
| FP | 1,654 / 1,272 | 3,716 / 1,603 | 3,967 / 3,330 |
| CF | 1,091 / 1,606 | 2,967 / 2,043 | 3,717 / 1,160 |
| RC | 0,978 / 0,498 | 1,301 / 1,462 | 1,793 / 1,761 |
| SG | 1,165 / 1,361 | 1,005 / 2,068 | 1,625 / 2,896 |
| VC | 0,780 / 0,368 | 0,783 / 0,072 | 1,196 / 0,030 |
| RF | 1,110 / 1,995 | 3,412 / 3,070 | 4,333 / 4,389 |
| WT | 0,406 / -0,399 | 1,634 / -0,352 | 2,017 / -1,411 |
| DC | 1,584 / 1,401 | 2,807 / 2,291 | 3,657 / 3,802 |
| DD | 1,086 / 1,458 | 1,944 / 1,694 | 2,801 / 2,757 |
| (Constant) | -10,964 / -14,933 | -41,327 / -29,163 | -62,632 / -53,468 |

*Note.* Fisher's linear discriminant functions.

The variables found in Table 3 served as a basis to the construction of the models below, so it was possible to note which variables that most discriminated each group. If a ranking of the three most important variables in the discrimination of each group was made, the ones that were highlighted in the table could be observed. It was noticed that the variable FP (Forms of Payment) was the variable that most helped to discriminate the largest part of the groups, however, the group that most discriminated Uber's users was the one that obtained the largest sum of the coefficients of the equations below:

***Certain degree of dissatisfaction (UBER):***

$U_d$ = 1,071 (TP) + 1,654 (FP) + 1,091 (CF) + 0,978 (RC) + 1,165 (SG) + 0,780 (VC) + 1,110 (RF) + 0,406 (WT) + 1,584 (DC) + 1,086 (DD)

$$\boldsymbol{U_d = 10,92}$$

***Indifferent (UBER):***

$U_{in}$ = 2,491 (TP) + 3,716 (FP) + 2,967 (CF) + 1,301 (RC) + 1,005 (SG) + 0,783 (VC) + 3,412 (RF) + 1,634 (WT) + 2,807 (DC) + 1,944 (DD)

$$\boldsymbol{U_{in} = 22,06}$$

***Certain degree of satisfaction (UBER):***

$U_s$ = 2,422 (TP) + 3,967 (FP) + 3,717 (CF) + 1,793 (RC) + 1,625 (SG) + 1,196 (VC) + 4,333 (RF) + 2,017 (WT) + 3,657 (DC) + 2,801 (DD)

$$\boldsymbol{U_s = 27,53}$$

As previously mentioned, the group that most discriminated **Uber's users** was the one that obtained the largest sum of coefficients, which was the "**certain degree of satisfaction**" group, with a sum of **27.53**, and the variable that best discriminated this group was the "Service Request Facility" (RF). So, the same was done with Taxi's users. And if a ranking of the three most important variables in the discrimination of each group was made, the ones that were highlighted in the table could be observed. It was observed that the variable TP (Travel Price) was the variable that most helped to discriminate the three groups; however, the group that most discriminated the users of Taxi was the one that obtained the largest sum of the coefficients of the equations below:

***Certain degree of dissatisfaction (TAXI):***

$T_d =$ 2,697 (TP) + 1,272 (FP) + 1,606 (CF) + 0,498 (RC) + 1,361 (SG) + 0,368 (VC) + 1,995 (RF) - 0,399 (WT) + 1,401 (DC) + 1,458 (DD)

$$\boldsymbol{T_d = 12,26}$$

***Indifferent (TAXI):***

$T_{in} =$ 3,386 (TP) + 1,603 (FP) + 2,043 (CF) + 1,462 (RC) + 2,068 (SG) + 0,072 (VC) + 3,070 (RF) - 0,352 (WT) + 2,291 (DC) + 1,694 (DD)

$$\boldsymbol{T_{in} = 17,34}$$

***Certain degree of satisfaction (TAXI):***

$T_s =$ 5,106 (TP) + 3,330 (FP) + 1,160 (CF) + 1,761 (RC) + 2,896 (SG) + 0,030 (VC) + 4,389 (RF) - 1,411 (WT) + 3,802 (DC) + 2,757 (DD)

$$\boldsymbol{T_s = 23,82}$$

As mentioned before, the group that discriminated the most among **users of Taxi** was the one that obtained the largest sum of coefficients, which was the "**certain degree of satisfaction**" group, with a sum of **23.82**, and the variable that best discriminated this group was the own "Travel Price" (TP). However, if we decided to compare the models of the users of the two services that was showed above, it could be noted that the group "**some degree of dissatisfaction**" was better discriminated by users of **Taxi** ($T_d$ 12,26 > $U_d$ 10,92); and the "**indifferent**" ($U_{in}$ 22,06 > $T_{in}$ 17,34) and "**some degree of satisfaction**" groups ($U_s$ 27,53 > $T_s$ 23,82), were better discriminated by **Uber's users.** So, it was possible to noticed six models created by the user's perceptions that could be called "models of satisfaction and dissatisfaction of users from Uber and Taxi services in the city of Rio de Janeiro – Brazil".

About the results of the classifications of the groups, in Uber's case, 94.2% of the observations were classified correctly, and in Taxi's case, 92.2%. This represents an excellent result regarding the classification of the variables in the correct groups.

With the existence of three groups in the study (some degree of dissatisfaction, indifferent, some degree of satisfaction), two discriminant functions were created. And through these results, it was possible to notice that in both cases the first discriminant function was the one that best contributed to the demonstration of differences between groups, with Uber function 1 being 96.80% and Taxi being 94.80%. Thus, in both cases the second discriminant function did not demonstrate a relevant power to discriminate the groups, reaching only 3.20% (Uber) and 5.20% (Taxi), with explanatory power.

## 5. Final Remarks

Although exist regulatory differences between these transport services, and that some users have preferences to a service, the research has shown that customers are neither necessarily against Taxi nor Uber. Thereby, the survey revealed that customers are quite sensitive to some important items such as: prices, forms of payment, comfort, safety, driver cordiality; and these often end up being the determining factors in the choices of consumers. Therefore, it is believed that competition is necessary to improve the services provided, to provide users with choice and to force the prices of these services to fall.

In Uber's case was identified that "Comfort" variable was the one that obtained the best discriminating power between the means of the groups, given its low **Wilk's Lambda test** result. Opposite to this, the variable that worst discriminated the means of the groups was the item "Safety". Regarding Taxi's service, was identified that variable "Reliability and Credibility" was the one that presented the best discriminating power between the means of the groups. On the other hand, the variable that had the worst discriminatory power of the means of the groups was in relation to the "Vehicle Conservation state".

Our results in this investigation arrived at managerial and theoretical implications related to Uber and Taxi service quality - what becomes this paper relevant to build knowledge in this theme. In our point of view, these results in theoretical perspective, highlight (i) the main attributes that generate some degree of dissatisfaction among Taxis such as **travel prices, service request facility and comfort;** (ii) in contrast, in the case of Uber, the main attributes that generate some degree of dissatisfaction such as **forms of payment, driver's cordiality and safety.** Despite these two theoretical implications, the third one is to rank relevant variables whose are important to understand satisfaction and dissatisfaction related to ridesourcing and taxi's industry. Managerial implications could be associated in Uber's case to relational boycott (Cruz & Botelho, 2015) - when a consumer boycott due lack of attention, respect or cordiality.

Regarding satisfaction with Taxi's services, the customers pointed out the main attributes that generate this perception were: **travel price, service request facility and driver cordiality.** In the case of Uber, the determining attributes for customer satisfaction were: **service request facility, forms of payment and comfort.** It is interesting to note that the "forms of payment" influences both Uber users' satisfaction and dissatisfaction, the same occurs with "travel prices" in the case of taxis' users'; and the "service request facility" cause certain degree of satisfaction in Uber's and Taxi's users, but it is more discriminant in Uber's users' case. In this way, it was possible to perceive that most of the attributes that generate dissatisfaction in the users of Taxi services are basically the same that provoke satisfaction to Uber users' and vice-versa. Managerial implications could be understood based on these results. For example, in Brazilian case, ridesourcing companies may build marketing strategies to minimize consumer's perception of dissatisfaction related to 'forms of payment'.

In this way, it was possible to notice that the answers to the hypotheses could be simplified in this form: **(i)** $H_1$ – rejected; the variable that best discriminated ubers satisfaction was the "Service Request Facility (RF)" and not "Travel Price (TP)"; **(ii)** $H_2$: rejected; the variable that best discriminated uber dissatisfaction was the "Forms of Payment (FP)" and not "Driver Cordiality (DC)"; **(iii)** $H_3$: rejected; the variable that best discriminated this group was the "Travel Price (TP)" and not "Service Request Facility (RF)"; **(iv)** $H_4$: accepted; "Travel Price (TP)" was the most important variable whose discriminates Taxi dissatisfaction service.

Future researches interested on ridesourcing or taxi's industry could investigate some questions based on results presented in this paper. For example: (i) do consumers have intention to boycott ridesourcing services when they have a bad experience related to driver's cordiality? (ii) could **service request facility, forms of payment and comfort** be associated to buycott intention in ridesourcing services? (iii) is it possible to measure quality of ridesourcing service

by a marketing scale? These and other questions can be answered by researchers who are interested to understand ridesourcing services in Marketing.

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## APPENDIX A – LEVEL OF SATISFACTION WITH TAXI OR UBER ATTRIBUTES*

| Variables | Very dissatisfied | Dissatisfied | Normal | Satisfied | Very satisfied | N/A |
|---|---|---|---|---|---|---|
| **Travel Price (TP)** | | | | | | |
| **Forms of Payment (FP)** | | | | | | |
| **Comfort (CF)** | | | | | | |
| **Reliability and Credibility (RC)** | | | | | | |
| **Safety (SG)** | | | | | | |
| **Vehicle Conservation (VC)** | | | | | | |
| **Service Request Facility (RF)** | | | | | | |
| **Waiting Time (WT)** | | | | | | |
| **Driver Cordiality (DC)** | | | | | | |
| **Driver's Domain (DD)** | | | | | | |

* The questionnaire used was the same for both Uber users and Taxi users, the title only contains the names of the two together to avoid using 2 appendices that explain exactly the same thing.