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WHAT DO BROADBAND CONSUMERS WANT? DESIGN AND EXECUTION OF A QUESTIONNAIRE ON DEMAND FOR BUNDLED SERVICES ON THE PORTUGUESE TELECOMMUNICATIONS MARKET.

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ABSTRACT

The report addresses the question of what are the preferences of broadband consumers on the Portuguese telecommunication market. A triple play bundle is being investigated. The discrete choice analysis, adopted in the study, base on 110 responses, mainly from NOVA students. The data for the analysis was collected via manually designed on-line survey. The results show that the price attribute is relatively the most important one while the television attribute is being overlooked in the decision making process. Main effects examined in the research are robust. In addition, "extras" components are being tested in terms of users' preferences.

Keywords:

broadband consumer, bundled services, conjoint analysis, telecommunication market

Table of Contents

1. Introduction

The bundling of telecommunications services has recently become very popular and widely available on technologically advanced markets in the European Union. It might have been achieved because of increase in the quality of technological convergence of voice, video and data. According to the numbers provided by the European Commission (2010), around one-fifth of Europeans claimed that their households bought more than one communication service as a part of a bundle at the end of 2006. Already in 2009 this number reached the level of 38%. Although many studies regarding bundling services had been conducted, either from the economic modeling perspective or the marketing-oriented perspective, no one single definition of bundling among the academic community was developed. However, based on the knowledge available in the literature, two types of bundling can be objectively distinguished: *pure and mixed*. Pure bundling refers to the case in which different goods are sold together in fixed proportions and consumer can only buy a package of them or nothing at all. In contrast, mixed bundling occurs when a firm offers consumers a choice between a bundle and separate products or components (Srinuan P., Srinuan C., Bohlin, 2014). In the market reality mixed bundling is more commonly used as the telecommunication providers do not want to limit customers' choices and the number of possible product combinations. Obviously, when clients come into close relations with a one single supplier the question of what is the impact of bundled offers on competition policy and market definition arises. The Portuguese telecommunications industry has come through the series of events that created the present mature, middle-sized but very efficient and technologically advanced market with mobile penetration that exceeds the European Union average. The privatization of Portugal Telecom (PT), the national incumbent company, in 1996 was a starting point for liberalization of the market which is dated on 2000. Since that time many entrants appeared on the market, first using Portugal Telecom's network. Until 2006 an arduous process of building a new

consumer base and gaining market power and autonomy through investments in own infrastructure was observed. After 2006 a chance for further development appeared in Portugal in the form of unbundled local loops. As a consequence, many innovative products, for instance bundles, were introduced in the market (Pereira, Ribeiro, Vareda, 2013).

The telecommunications providers tend to establish business relations with their clients by pushing them to sign long-term contracts. It results in less freedom of change from the customer's perspective and higher revenue-generation potential from the supply side. However, customers have an opportunity to satisfy their needs at a lower price compared to buying each service separately. In addition, consumers may benefit from obtaining the bundle as they receive a single bill and potentially improved functionality of the services when purchased from a single provider (BEREC report, 2010). One can also observe a significant reduction of transaction costs, especially in the category of search and information costs. The principal objective of the report is to identify the importance of bundle's specific attributes. Bundled services investigated in the report consist of: mobile telephony, television, fixed internet and the price coefficient. The author's aim is to find out which of these features have a decisive influence on decision making by customers. To do this an on-line, manually designed, survey is implemented via Survey Monkey platform. It is one of the most commonly adopted cloud-based tool which enables users to create customized surveys and collect responses in real time. 110 stimuli are used in the research. The gathered data is being analyzed with conjoint analysis which is a quantitative methodology used in the marketing research field. The conjoint studies characteristics make a process of gathering information very intuitive for respondents and relatively easy to perform for researcher. It provides robust part-worth utilities of the levels of each attribute. These coefficients are then used to calculate relative importance of the latter. Conclusively, the price factor has the greatest impact on clients' purchasing behavior while the television attribute is being neglected. In addition, the

relationship between extras added to the market offers are being examined in the report. Calculations are done in the Excel software. It turns out that full access to mobile platforms (TV, music) is the most popular add on among users. Possible future developments of the research are also included in the report.

2. Market Overview

One can observe that needs expressed by broadband consumers can be satisfied on the Portuguese telecommunication market by following providers:: Vodafone (ex Telecel) with 5.964 million users at the end of 2013, MEO (ex TMN) with 7.840 million users and NOS (ex Optimus) with only 2.279 million users. Hence, a triopoly situation exists in the industry. The total number of subscribers reached 16.083 millions in December 2013. Furthermore, the mobile penetration (around 150%) was above the average number recorded in the European Union at that time (Huq, 2014; Lancaster 2015). This high level of subscriptions is being supported by considerable use of multiple SIM cards. Any changes in the shares of active users among incumbents that might occur on the market are reflected mainly by switches between existing operators. The market share composition of valid subscribers is presented below in **Figure 1.**

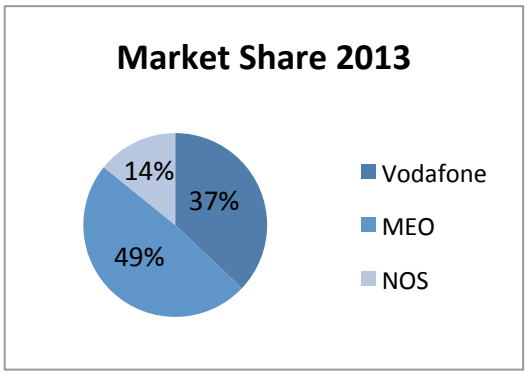

Figure 1. *Active Subscribers Market Share 2013. Source: ANACOM, 2013*

The three incumbents might be identified as major players, because they have a direct, significant impact on the whole process of the telecommunication business, starting from

electronic devices and infrastructure building at the end-users ending. Hence, the Portuguese telecommunication market may be considered as moderately competitive (Huq, 2014).

3. Methodology

Overview

From a broadband customer's perspective there is a desire to maximize the utility by acquiring products (services) which are composed of the most preferred features, at the lowest possible price. In a real life, consumers tend to reveal their preferences through choices. In order to learn what people truly value one should force them to make difficult tradeoffs between attributes' levels of bundled services. Comprehension of how modifications of certain characteristics of products influence customers' preferences is in the spotlight of many human sciences including psychology, economics, marketing, management or transportation (Raghavaro, Wiley, Chitturi, 2010).

In order to address these issues a questionnaire on demand market was designed and executed. .The survey is divided into three sections. Socio-demographic questions ask about gender, age, amount of money one can dispose each month, job status and the country one lives in. The core section consists of ten choice sets each composed of three different bundle combinations and a "None" option to choose which are considered as the proper choice based conjoint analysis. The author would like to emphasize that after re-evaluation of the experimental design one of the choice sets was rejected from the analysis and not being taken into account while computing results. The last part includes ranking of extras components offered by telecommunication providers on the market. The survey is available to look up upon request.

The empirical collection of data was done via Facebook and mailing. As a result a total number of 221 responses was collected. However, only 185 (83.71%) people fully completed the queries. Next, the author selected a group of people whose country of residence is Portugal and this number equals 124 (56.10%). The final step involves the exclusion of illogical records. One of the choice sets plays the role of the control question. It is a combination of the highest levels for the lowest price as well as the lowest levels for the highest price. This particular choice set was created in order to check the logical reasoning of respondents. If one chooses objectively not preferred bundle its record is excluded from the research. Because of this small adjustment the face validity of the sample is enhanced.

Conjoint methodology is used to analyze the results obtained from the questionnaire. Conjoint analysis has its roots in the 70s, when academic specialists started to look deeper into the nature of humans decision taking. In the late 90s an improvement called choice based conjoint (CBC) occurred in the commercial use. Following the line of argument in Bouwman et al. (2007) the author concludes that in terms of research on consumer preferences, demand and decisions taken related to expanded service bundles, conjoint analysis delivers better results compared to standard research methods that are experiments and simple surveys. Among conjoint analysis alternatives, choice based conjoint (CBC), in other words discrete choice conjoint, is the most appropriate approach. There are four main components of every conjoint analysis: attributes and levels, experimental design (full factorial, fractional factorial, etc.), choice method (direct choice, ranking, etc.), method of analysis (Counts, Multinomial Logit, etc.). One of the main advantages of CBC is that derived conjoint utilities show a direct impact on choices. It means that shares are directly estimated and no additional rules are necessary to apply in order to make the results valid.

Generic, plain vanilla, main effects are basic kind of effects in a discrete choice conjoint. These effects measure conjoint utilities of each level of each attribute *ceteris paribus* (Chrzan

and Orme, 2000). Joint effects are similar to main effects but gives knowledge about pairs of attributes considered at a time. Choice based conjoint is an efficient way to collect data for studying main effects, joint effects and interactions between attributes. One of the interesting characteristic features of the CBC is a possibility to set a common price information for a single package deal rather than for all listed attributes or levels separately. It means that a certain bundle of services (composition of attributes) is shown to respondents under one price.

In the study no bundle discounts are used. The price information is treated as a single loss that a customer must bear in order to choose a preferred concept among all combinations that appear in a choice set. This advantageous aspect imitates a real-life situation when a client is presented an amount of money which stands for the price of acquisition of a bundle offer. However, discrete choice conjoint has also several disadvantages. Unlike other techniques, it preferably allows to do calculations on an aggregated basis. Instead of analyzing utilities for each individual respondent it generates collective results for the whole sample. At the individual level it is rather infeasible to execute due to the lack of sufficient observations per interviewee. Hence, contrary to traditional conjoint analysis, it is impractical to form market segments *post hoc* (Elrod, Louviere, and Davey, 1992). If one wants to do this in the CBC, it is possible to include additional variables (socio-demographics) to execute *a prori* segmentation (Desarbo, Ramaswamy, Cohen, 1995). Estimations at the aggregated level might cause a major problem for instance in consumer's willingness-to-pay measurement. In the research this issue is not a significant obstacle, since the surveyed group is very consistent and relatively homogenous. It is assured in the socio-geographic data checked while conducting the study. Although a plain conjoint analysis seems more feasible and simpler in analysis the author refused this approach and decided to follow choice based conjoint. The reason is that for on-line surveys (manually created) it is not practical to ask interviewees to choose between more than three or four concepts at a time. Cognitive stress is claimed to be

too high. A survey may remain incomplete and results regarding utility calculation might be biased (Survey Analytics, 2015). This situation is confirmed in the paper of Klein and Jakopin, 2013. The researchers followed plain conjoint analysis (sixteen offers ranking) and collected empirical data via on-line survey. It turned out that even if results remained robust, the complexity of a task caused a very low response rate. Only 28% of total responses could be integrated into the analysis.

Attributes and levels

The principal objective of conjoint analysis is to determine general features of products, called attributes, in order to examine them in a consistent way. Attributes are made up of particular levels. Each combination of telecommunication bundle used in the research is described by four attributes that are expressed by one of three possible levels. Attributes should be objective, clearly described and mutually exclusive while levels should be stated concretely and have unambiguous meaning (Survey Analytics, 2015). Attributes and levels are independent variables of choice based conjoint study. The full list of parameters is presented in **Figure 2**.

Attributes	Attribute levels
Mobile Internet	• 500 MB • 1 GB • 3 GB
Television	• 129 channels (basic) • 169 channels advanced (basic + sport, film, music) • 200+ channels premium HD (advanced + HD, HBO)
Fixed internet (unlimited)	• 40 Mbps (satellite) • 100 Mbps (fiber) • 200 Mbps (fiber)
Price (euro)	• € 44,99 • € 54,99 • € 64,99

Figure 2. *Attributes and attribute levels of telecommunication services' bundles*

Setting an equal number of possible levels to appear with each of the attributes prevents from increasing the validity of an attribute with a larger number of levels. Respondents should not

be overloaded by the number of attributes in each combination because it reduces perception and brings confusion to valuation of bundles. The leading scientists imply six as a maximum number of attributes used in a full profile conjoint analysis (Green, Srinivasan, 1990). Hence, the number of four attributes applied in the study is claimed as an optimal proportion between the best description of products and a loss of attention from participants. Even then, one can observe a behavior of ignoring negligible attributes and using shortcut heuristic by respondents in order to select most preferred product concept (Sawtooth, 2013). Selection of attributes and levels is based on real offers of three main operators present on the Portuguese telecommunication market: Vodafone, MEO and NOS. Offers comparison were done in September 2015. The author examined carefully available bundles and decided to base the study on triple-play bundles while excluding fix telephone property. The marginal cost of the latter is very low and become irrelevant to the overall price of a bundle. Price attribute represents monthly basic fee for a service. It is constantly under downward pressure due to seasonal promotions and competition. Therefore, the structure of price levels respects this motion. In terms of other attributes the lowest extreme levels have been rejected because of the continuous shift towards bundles containing higher quality services. Moreover, the most basic features of mobile phones are rejected in the study as nowadays text messages and minutes included are flat rate (unlimited) in all examined packages.

Experimental design

In an experiment, one intentionally changes process factors to discover the effect the modification has on response factors. An experimental (statistical) design is an efficient procedure for planning the stimuli for experiment in order to collect data which provides valid and objective conclusions (NIST/SEMATECH e-Handbook of Statistical Methods, 2012). It is the most troublesome part of the research. With four attributes and three levels each, it is not practical to test all 81 combinations. Therefore, a fractional factorial design is applied to

make the study more feasible. It is a design created of 9 subsets. Respondents are supposed to value these subsets and reveal their purchasing inclinations. The number of subsets follows the general recommendation from Sawtooth Software Research Paper Series (2013) to ask about 8 to 15 choice tasks. Moreover, according to the same authors, the minimum number of choice sets is expressed by the following "rule of thumb":

- *minimum number of choice sets* = 1 + *number of attribute levels* - *number of attributes*

In the study this number equals to nine. Hence, the experimental design has a sufficient number of subsets. It is essential for the robustness of results that a statistical design meets two criteria: being orthogonal and balanced. In case of the latter it means that in a model each level and each attribute appears the same number of times. Orthogonality means that each pair of levels, one from one attribute and one from another attribute, has to appear the same number of times in a model (Dobney Research, 2015). The evidence for orthogonality and balance of the experimental design as well as the design itself can be found in **Appendix 3.** The virtue of orthogonality gives an assurance that the effect of one element or interaction can be measured separately to any other effects (Minitab17 Support). Furthermore, symmetric orthogonal designs provide researchers with the most effective results in terms of calculating main effects which is the principal outcome of the study (Sawtooth, 2013). The symmetry is based on the fact that each attribute has an equal number of levels. The author is constrained to usage of a fixed orthogonal design because of the format of the questionnaire. Available on-line tools allow only for a creation of a single version of the survey presented to all respondents. Applied statistical design is commonly marked as "3^4". This notation means four attributes with three levels each. The design is based on the 9 choice sets experiment first used by Addelman (1962) that has an integrity of respectively uncorrelated (orthogonal) levels, see **Appendix 1.** However, this kind of traditional fractional factorial designs is used in plain conjoint only. In order to adopt it to choice based conjoint methodology a "mix and match"

approach is being followed. The design is described in Louviere (1988). Six steps are involved, taken from the paper of Chrzan and Orme (2000). See **Appendix 2 for the instruction**. This particular design is potent to explain three kinds of effects: main effects, joint effects, interactions and alternative specific effects (not covered in the study).

Choice method

In usual choice based conjoint analysis, study participants are asked to select a single alternative from a set of concepts of which every choice set is composed. (Desarbo, Ramaswamy, Cohen, 1995). The study sticks to this standard and allows for a single choice only, that implies the most preferred combination of attributes. It is called a direct choice method. Moreover, each choice set includes a "None" option which allows for not choosing any of proposals. It firmly reflects a real market situation in which users might not want to buy any of bundled combinations offered. It makes the questionnaire more realistic and improves the quality of data by allowing users to screen out bundles they would never choose. It is recommended to include the "None" option, estimate its utility level (effect) but disregard while conducting market simulations (Sawtooth, 2013). The typical incidence of a "None" choice in a research should be between 5% and 15%. Otherwise, it means that the subject group is wrongly selected or attribute levels should be reconsidered (Sawtooth, 2003). In the study "None" selection falls to 11% of all cases where it was available to choose.

Method of analysis

Through the notion of orthogonality it is possible to estimate the impact of each level simply by counting the proportion of times each level is selected to the number of its total occurrences. It is called "Counting" approach (Sawtooth Software, 2003). Discrete choice analysis allows for using prohibitions that is to deny certain combinations of levels to include in a questionnaire. However, since the author did not use prohibitions, counts have very

similar properties to conjoint utilities (average part-worths). The results of calculation are proportions which are the ratio data (Orme, 2010). Hence, every elemental arithmetic computation, as dividing or multiplying can be done using the outcome of the study. It is also correct to say that the difference between 0.2 and 0.3 is the same as between 0.4 and 0.5 but one cannot compare proportions between attributes' levels. "Zero" is the reference point here. Counting method is valid while doing calculations of both: main-effects and joint-effects (Sawtooth, 2013). Moreover, elementary research questions, like obtaining price sensitivity curves might be also derived. The main advantage of the Counting approach is its simplicity that comes altogether with robustness of the results. The outcomes are easy to communicate without going deeper into complicated reasoning and assumptions. Although, if one wants to simulate a particular bundle's market share within a competitive market conditions a different approach should be considered (Sawtooth, 2003). Counting method provides marketers with top line knowledge about results but is also a very useful tool to summarize important relationships between attributes.

4. Results

Overview

Overall, 110 (49.77%) responses are included into the final discrete choice analysis and 123 (55.66%) into extras preference calculations. Those two numbers differ due to the fact that the author does not include stimuli with only "None" option answers into the conjoint analysis. According to the complexity of the exercise and high attention required from interviewees during solving it, the final number of valid responses is satisfactory. Therefore, the collected data comprises a suitable sample for the inquiry on broadband customers preferences. Following the paper of Orme (2010) in order to obtain valid conclusions

regarding investigational work and basic hypothesis about a field of interest already between thirty and sixty responses are needed.

There are two types of errors occurring in every model: sampling error and measurement error. These errors are deviations from validity. The former reflects differences between a random sample and a population while the latter comes from insufficient data received from individual respondent and poorness of its quality. If one considers pooled estimation of effects in a full profile analysis the rule of thumb exists in order to determine a sufficient sample size for a study, following Johnson and Orme, 2003:

- *number of respondents* × *number of tasks* × *number of alternatives per task (excluding "None" option) / number of analysis cells (the largest interaction)* ≥ 500

In the study, for main effects, this figure equals to 990 which significantly exceeds the required minimum. Moreover, following the paper of Johnson and Orme (1996), the author determines the margin of error for a proportion (assuming that choices made by interviewees are independent of one another). For main effects it is expected that the margin of error is +/- 2.94% for the 95% confidence interval. For more detailed calculations please look into **Appendix 4.** Even though, for joint effects the author did not manage to achieve required minimum of sample size and results may be prone to higher measurement and sampling error.

A share of 51.82% of the interviewees from the filtered sample are female and 48.18% are male. Moreover, the great majority of participants are either marked as students only or as students who are employed at the moment of the research (80.91%) while employees stand only for 17.27% and unemployed respondents for 1.82%. In addition, disposal income of participants ranges from <€450 (33.64%), €450-€700 (24.55%), €700-€1000 (21.82%), €1000-€1500 (14.55%), €1500-€2000 (2.73%), to €2000< (2.73%). Exactly 58.18% of participants dispose below €700 per month. The sample group reflects lower monthly income

compared to the average net wage in Portugal for a single person without children; €1056.93 (Eurostat, 2014). One should take into consideration that the principal outcome of the analysis might be biased towards concerning pricing issues as more important than other characteristics due to the low age of participants. It ranges from 18-23 (57.27%), 24-29 (35.45%), 30-44 (6.36%), to 45-59 (0.91%). Great majority of participants are below 30 years old.

Conjoint utilities and attributes importance

The bottom line of the study is to estimate the main effects. Average part-worth utilities are derived from the data, in a form of proportions, along with relative importance of attributes that shows what is the impact of each attribute on the total utility of a product. It is done via Counting approach by calculating proportions for each level, built on how many times a bundle service containing a certain level is chosen, divided by the figure showing how many times this level occurs (Sawtooth, 2013). There are two possible ways of how to calculate relative preferences based either on differences (ranges) or the ratio between the highest and the lowest conjoint utilities of levels within each attribute.

In the 1st approach percentages from relative ranges are computed. Each attribute utility range of levels is determined and further divided by the total utility range which is the sum of respective attribute utility ranges. Thus, the entire set of importance principles that sum up to 100% is being acquired (Orme, 2010). The 2nd approach is especially advised for studies in which conjoint utilities are expressed as proportions. In order to outline the relative importance of every attribute the logs of ratios of two extreme conjoint utilities (proportions) of levels within each attribute are being computed. The percentage importance of a particular attribute equals the previously derived log divided by the sum of logs (Sawtooth, 2013).

Figure 3. exhibits a summary of relative importance of attributes and conjoint utilities of attribute levels measured in the study.

Attributes	Relative importance 1st approach	Relative importance 2nd approach	Attribute levels	Conjoint utilities (part-worth)
Mobile Internet	28.18%	28.76%	• 500 MB • 1 GB • 3 GB	0.185 0.321 0.384
Television	5.01%	4.75%	• 129 channels (basic) • 169 channels (advanced) • 200+ channels (premium)	0.311 0.303 0.276
Fixed Internet	20.60%	19.82%	• 40 Mbps (satellite) • 100 Mbps (fiber) • 200 Mbps (fiber)	0.222 0.300 0.368
Price	46.21%	46.68%	• € 44,99 • € 54,99 • € 64,99	0.470 0.277 0.143

Figure 3. *Relative importance of attributes and conjoint utilities of levels*

It turns out that both approaches reach similar results in terms of deriving relative importance of attributes. Conjoint utilities confirm the reasoning of the order of preferences of levels within each attribute. The lowest price level gives respondents the highest utility while for other features the best quality options are chosen the most frequently.

The only exception in which the objective quantitative order of preference is violated is annotated in the television attribute. One hypothesis explaining this occurrence follows a natural behavior of participants who rather simplify choice procedure by focusing on key attributes or decisive combinations (Sawtooth, 2013). People tend to omit certain features and use shortcuts while evaluating bundles. It is reflected in the marginal importance of the television for respondents, around 5%. It is a situation in which this specific characteristic is disregarded and proportions are unnatural. On the other hand, levels of the television attribute do not differ significantly from each other. They could be treated as indifferent. Over 100 channels in the worst case may be already good enough. "Importance depends on the particular attribute levels chosen for the study. For example, with a narrower range of prices,

price would have been less important." (Orme, 2010). Nevertheless, conjoint utilities of the television levels deviate from expected patterns due to the combination of both effects.

It is important to emphasize that part-worth utility of levels, expressed as proportions, cannot be compared between attributes in reference to preferences due to the arbitrary origin of these values (Orme, 2010). One cannot conclude that for example 1 GB of mobile Internet (0.321 part-worth) is more preferred to 100 Mbps speed of fixed internet (0.300). One can observe that conjoint utilities do not sum up to 1. The missing balance, in the form of 0.110, is the proportion of tasks in which respondents selected "None" alternative. This value also stands for the utility of "None" option. It can only roughly demonstrate the amount of people who would refuse to acquire certain combinations on the market. Since there is little evidence for high accuracy of these estimations, referring to Sawtooth (2003), the author does not include such analysis in the report.

The price attribute (monthly basic fee), expressed in euro, has a decisive influence on the choices made by participants during the study with above 46% relative importance. The price component of bundled services is 1.5 times more important for participants than the mobile Internet attribute and almost 2.5 times more significant than fixed internet attribute while taking decision on selecting certain package.

Joint effects

The joint effects diagram with columns of information provides an essential overview of each level's share of choices when offered at each price level. In **Figure 4** one can observe pairs of attributes with estimated proportions of choices. For instance 500 MB of mobile Internet is chosen 0.348 times at the price level of €44,99 while only 0.061 times when shown altogether with the level of €64,99. It means that this level of mobile internet is chosen 5.5 times more often at the lowest possible price than at the highest. However, with the modest

sample size used in the study (110 stimuli) in terms of joint effects one cannot conclude that results are significant.

	€ 44,99	€ 54,99	€ 64,99	Average
500 MB	0.348	0.145	0.061	0.185
1 GB	0.448	0.339	0.176	0.321
3 GB	0.612	0.345	0.194	0.384
40 Mbps	0.361	0.248	0.058	0.222
100 Mbps	0.427	0.339	0.133	0.300
200 Mbps	0.621	0.242	0.239	0.368
129 (basic)	0.345	0.400	0.188	0.311
169 (advanced)	0.582	0.136	0.185	0.301
200+ (premium)	0.476	0.294	0.058	0.276
Average	0.470	0.277	0.143	

Figure 4. *Joint effects of pairs of attributes*

Mobile internet and fixed internet is the pair of attributes with the highest relative importance, respectively around 30% and 20%, second only to the price characteristic. Therefore, it is worthwhile to examine the joint effect between these two attributes. As it is shown below in **Figure 5**, one can conclude that when the 200 Mbps speed of fixed Internet is available to choose, there is not much difference for respondents between the levels of mobile Internet in terms of preferences (proportions). Furthermore, this basis applies even more for the maximum level of mobile internet, i.e. 3 GB. Hence, the maximum levels of each attribute can be treated as a low degree substitute for another attribute. Participants are not significantly worse off in these cases.

	40 Mbps	100 Mbps	200 Mbps
500 MB	0.133	0.152	0.270
1 GB	0.261	0.339	0.364
3 GB	0.273	0.409	0.470

Figure 5. *Joint effect of mobile Internet vs. fixed internet*

In addition, respondents reveal a meaningful need to choose mobile internet's capacity above 500 MB. It is a considerably higher proportion compared to the lowest level of fixed internet.

Price sensitivity analysis

By the application of discrete choice analysis the author has an opportunity to look at the interactions between attributes. The mobile internet component of a bundle proves to be the most important, related to other qualitative attributes. **Figure 6** presents a chart with graphic illustration of the relative demand for each of its levels. These figures are derived from the joint effect of two attributes: price and mobile internet. The price sensitivity for different levels of mobile internet is reflected by the slope of a demand curve for each level. A linear trend function has been applied to depict the results. The steeper the slope is the greater price sensitivity a level has. The graph shows that changes in prices affect the demand for every level.

Price parameter of €54,99 is the average amount of money that respondents are about to pay for a chosen bundle of services. At this level the demand for 500 MB of mobile internet is 14.5%. An increase in the price to €69,99 causes a decline of demand to the position of 6.1%. A percentage change of the demand equals to -58%. The resulting elasticity estimate is -3.21. Using the same price points the elasticity estimates for remaining levels i.e. 1 GB and 3 GB of mobile Internet attribute equal -2.65 and -2.41 respectively. It demonstrates that people are more willing to quit choosing poorer levels of mobile Internet when the price is going up. A decrease in the price to €44,99 causes a growth of demand. The elasticity estimates for all three levels (starting from 500 MB) equal -3.20, -1.34 and -2.40 respectively. This kind of calculations have been also done regarding the fixed internet attribute. The results are comparable, although one interesting point is noted. The elasticity estimated for the maximum level of fixed internet attribute, using the same price points, equals to -0.07. It suggests that

respondents are willing to pay extra amount of money to keep 200 Mbps speed of fixed internet in a bundle.

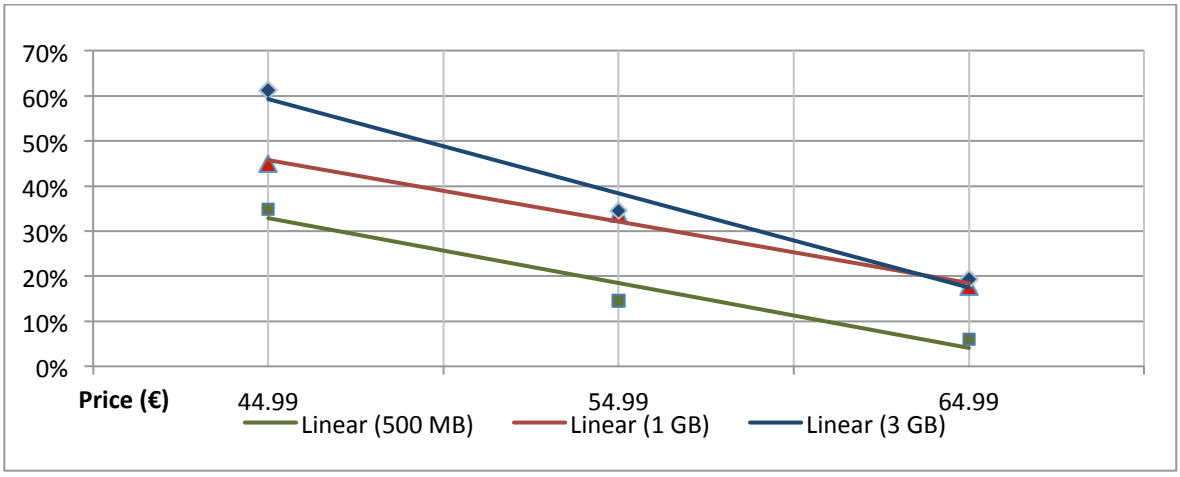

Figure 6. *Price sensitivity of mobile Internet attribute*

Extras

Telecommunication providers that operate on the Portuguese market include additional features while selling packages of services. This move is aimed to lock-in more customers within one network. The author selected the most popular extras to examine the usefulness they bring to customers. The sample size is 123 respondents who ranked five add-ons in their preference order (from 1 to 5). Participants were asked which additional feature they would like to include most in their offer. The sample characteristics are almost the same as in the sample used in the conjoint analysis study. The summary is shown in **Figure 7.** According to the scores, people value most the possibility of having accesses to mobile TV or music platforms. The average score is around 3,40 points in both cases. On the opposite extreme of preferences is situated an antivirus software for Smartphone. The average score reached only 2,41 points. More detailed data describing findings, including standard deviation and dominant figures, is available in the **Appendix 5.**

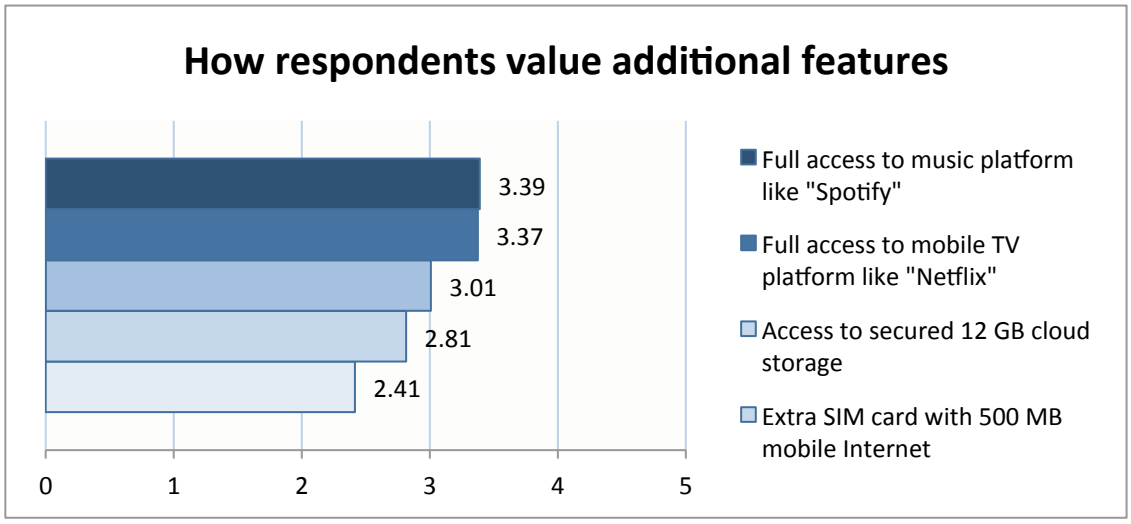

Figure 7. *Mean scores of extras within the sample*

In addition, it is worth to mention that females value very high an access to secured cloud storage system (3,26) while males do not perceive this additional function as that much useful (2,54). Another significant difference between ratings done by females and males is observed in the assessment of extra SIM card with 500 MB of mobile Internet. Women give this add-on a value of 2,63 while men of 3,00.

5. Conclusion

This report treats about broadband consumers' preferences on the Portuguese market. In order to examine this problem, an on-line questionnaire is run with further conjoint analysis conducted on the gathered data. One of the main findings is the dominant importance of the price attribute with over 46%. It is not a surprise because respondents are mainly young people that take decisions based on the price factor. The most preferred extras are mobile TV and music platforms. Accordingly, telecommunication providers are advised to put efforts in advertising the mobile internet attribute and to emphasize the presence of mentioned extras in their offers.

The main limitation of the study is insufficient sample size required to derive significant results for joint effects. This can be overcome by either gathering additional valid responses (170 in total) or by creating a different experimental design with at least 14 choice sets. Both possibilities have similar impact on the increase of statistical significance (Orme, 2010). Moreover, data eventually used in the analysis was collected on the Portuguese market. The great development of this work would be expanding the research on other markets. It might be an interesting task to compare results from developed market, the one in Portugal, with emerging markets like Polish or Hungarian and look for similarities and differences. Another limitation of the report refers to the nature of sample data. Although the homogeneity of respondents improves the results, it does not reflect the cross-section of the entire population and perception of results must be subjective.

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7. Appendices

Appendix 1. *3^4 Addelman Design for Profiles (1962)*

Profile	V1	V2	V3	V4
1.	1	1	1	1
2.	2	2	2	3
3.	1	3	3	2
4.	2	1	2	2
5.	2	2	3	1
6.	2	3	1	3
7.	3	1	3	3
8.	3	2	1	2
9.	3	3	2	1

For V1, let 1=500MB, 2=1GB, 3=3GB, and so on.

Appendix 2. *Instruction for the experimental design creation.*

1. Use 4 columns from the Addelman design to create a set of 9 profiles and place them in Pile A.
2. Use those four columns again, only this time switch the 3's and 1's in one (or more) of the columns and the 1's to 3's, etc. so that 9 rows are not the same as in step 1. Create these nine profiles and place them in Pile B.
3. Repeat step 2 to create a third unique set of profiles and a new Pile C.
4. Shuffle each of the three piles separately.
5. Choose one profile from each pile; these become choice set 1.
6. Repeat, choosing without replacement until all profiles are used up and 9 choice sets are created.

Appendix 3. *The experimental design and evidence of orthogonality*

Concept	V1	V2	V3	V4
1.	0	0	1	-1
2.	-1	0	0	1
3.	-1	1	1	0
4.	-1	-1	-1	-1
5.	1	-1	1	1
6.	1	1	0	-1
7.	0	1	-1	1
8.	0	-1	0	0
9.	1	0	-1	0
10.	1	-1	1	0
11.	1	1	-1	1
12.	0	-1	-1	-1
13.	-1	0	-1	0
14.	0	1	0	0
15.	-1	-1	0	1
16.	1	0	0	-1
17.	0	0	1	1

18.	-1	1	1	-1
19.	-1	1	-1	1
20.	1	-1	-1	0
21.	1	0	0	1
22.	0	-1	1	1
23.	0	0	-1	-1
24.	1	1	1	-1
25.	-1	0	1	0
26.	-1	-1	0	-1
27.	0	1	0	0

The sum of products of any two attributes' coefficients for every concept balance out (sum to zero).

$\sum_{i\neq j}^{n}\sum_{c=1}^{m} V_{ic} \times V_{jc} = 0$

V_{ic} - i^{th} attribute value for c^{th} concept, i=1...n, n=4; c=1...m, m=27.

V_{jc} - j^{th} attribute value for c^{th} concept, j=1...n, n=4; c=1...m, m=27.

Appendix 4. *Computing confidence interval for proportions (main effects)*

$0.029 = \pm 1.96 \times \sqrt{0.33 \times (1 - 0.33) \div 990)}$

The true values of the population conjoint utilities have 95% probability to fall within a confidence interval that equals to the computed sample part-worths ± 0.029.

990	Average number of occurrences of each cell
0.33	Average probability of a concept being chosen
0.029	The margin of error for a proportion

Appendix 5. *Extras properties summary; 5-best, 1-worst*

	Extra sim card with 500 MB mobile Internet	Access to secured 12 GB cloud storage	Antivirus software on Smartphone	Full access to TV platform like "Netflix"	Full access to music platform like "Spotify"
Score	346	370	297	415	417
Mean	2,81	3,01	2,41	3,37	3,39
Median	3	3	2	4	4
Standard deviation	1,47	1,21	1,41	1,30	1,45
Variance	2,17	1,47	1,98	1,70	2,09
Dominant	1	3	1	4	5