Application of conjoint-analysis for the estimation of multi-attributive product's utility

Abstract
Real estate housing market is the market of differentiated product, where consumers' preferences are distributed among a large number of product attributes. The structure of the preferences forms product utility, which could be measured by using decompositional methods. We implement hierarchical information integration approach that let us represent the real estate housing object utility as a sum of part-worth utilities of various attributes. Using special research design we obtain the estimates and apply them to measure the utility of current market offer. The results highlight that the reason of poor sales performance could underlie in the gap between consumers' preferences and real estate housing items configuration.

Keywords: conjoint analysis, part-worth utility, real estate housing market, concept evaluation.

1. Introduction

Real estate housing concepts' development, differentiation and positioning may be problematic when developers lack a complete picture of consumers' preferences. It is important not only to measure the affordable price of the accommodation – a house or an apartment – but the full range of preferred attributes (Iman, Pieng and Gan, 2008). The gap between what is provided by developers and expected by consumers may lead to the developers' profit loss and even more harmful market consequences, as far as real-estate housing market may be the driver of corresponding markets like home improvement and repairing services, construction materials etc.

Since 2006 regional real estate housing market in Russia has gone through several stages – from active growth and saturation through recession and currently to slight growth (according to Federal Statistics approx. 6% per year [15]) – due to the both macroeconomic trends and federal support program. At the same time the sales performance has been different within different segments and especially poor in the high-price housing segment (for instance, the in the example which we use in this paper only 10% of apartments were sold by the end of construction in comparison with on average 40% of apartments typically for the segment). Many reasons could be given to explain the low sales (location, unreasonable high price, apartment design etc.) – that evidently makes market research of consumers' preferences crucial. Our brief search has shown that less is done on the topic in Russia – we failed to find out whether regional developers use different research techniques to estimate preferences for the multi-attribute products like real estate items. Moreover, we revealed that the methods, which are practically used to measure consumers' preferences for real estate items, are limited to the compositional methods, whilst most researcher consider decompositional methods more appropriate to study complex decision making and consumers' preferences for multi-attribute products (Fiedler, 1972; Louviere & Timmermans, 1990).

We argue the complicated decision-making process could be viewed from integration information theory perspective. According to Louviere and Timmermans (1990) information integration theory: "assumes that individuals respond to multi-attribute alternatives, such as residential opportunities, by first valuing the levels of the attributes that describe the alternatives, and then cognitively integrating the values (part-worth utilities) associated with the levels of each descriptive attribute into some overall measure of utility or preference". Therefore, there is a need for assessing consumers' preferences and part-worth utilities towards certain attributes of properties in order to develop the housing concepts, which maximize the total utility.

The purpose of this paper is to implement the hierarchical information integration as the method of consumers' preferences measurement and relate the obtained results to the current market offer at the high-price segment of real estate housing market.

The paper is structured in the following way: first, we briefly describe the method of hierarchical information integration and its application for the real estate housing market; second, we present the research methodology and procedure and finally illustrate how the calculated results (part-worth utilities) could be applied to access the real estate housing items and make some conclusions. Research limitations and key references are listed at the end.

2. Literature review

Since the early 1970's, conjoint analysis and its applications has received considerable academic and industry attention as a major set of techniques for measuring buyer's trade-offs among multi-attribute products and services (Green & Srinivasan, 1990). The principle types of its application are the problems of new product or concept evaluation, positioning and repositioning and market segmentation (Wittnik & Cattin, 1989). The purpose of different sub-methods, united under the conjoint analysis 'umbrella', is to predict consumers' reaction

to the new products and services, which is difficult to measure by other methods of marketing research when we handle a large number of product attributes. In case of multi-attribute products we deal with the multi-level characteristics of the product, which differently contribute into the value of the product perceived by a consumer, called total utility (Lang, 2011). Therefore, the accurate measurement of different attributes' preferences could provide the managerial and marketing decisions on positioning and marketing-mix adjustment with information, which enhance company's market position.

Residential real estate choice is a trade-off process influenced by different attributes. Several researches applied conjoint analysis methods to solve the problems of pricing and apartment design (Fiedler, 1972), utility assessment and land use policy evaluation (Knight & Menchik, 1974; Lerman & Louviere, 1978), individual preferences' study (Findikaki-Tsamaouritz, 1982), consumer choice of residential property depending on the developer (Levy, 1995) and suburban real estate choice (Louviere & Timmermans, 1990). Louviere and Timmermans (1990) examined the methods used for preferences analysis and argued that major research techniques were not relevant to reflect and study of the decision-making process of such a multi-attribute product like an apartment or other residential real estate item. Given that, they proposed the hierarchical information integration method (HII), which allows one to study a large number of potentially influential attributes without greatly restrictive assumptions.

HII is the conjoint-based method, which reconstructs the double staged decision making process: individuals simplify choices by grouping the attributes into subsets. Such categorization allows individual to range product attributes within these subsets first and then rank the subsets being familiar with the attributes, which are combined into the subset. Using regression analysis, we could define the relative contribution of the subsets and the attributes within each subset to the total real estate item utility. Based on these estimations, the developers could possibly configure the real estate item's concept in order to increase the potential consumers' perceived value of the apartment and adjust the real estate item positioning to the preferences of target segment.

The primary focus of our study is the structure of preferences and their estimations for the various attributes of an apartment in the newly built apartment block at the high-price segment of real estate. This type of residential real estate property currently forms a large market share of the regional market and, what is more important, is characterized in some cases with the poor sales performance.

Based on the previous researches on consumer preferences for residential real estate market we have defined more than 25 product attributes which were be grouped into 5 subsets: location attributes, apartment block attributes, apartment attributes, building company attributes and price attributes (Louviere & Timmermans, 1992; Noortwijk, 1994; Vande & Vijvere, 1998; Oppewal & Klabbers, 2003; Leishman, Aspinall, Munro and Warren, 2004; Oldham / Rochdale Partners, 2006; Hamid, Pieng and Gan, 2008). The logical grouping of attributes was done in accordance to the structure of factors, which defined the real estate item price in Russia (Sternik & Sternik, 2009). For the purpose of our study, which is focused on the attributes' utility in application to the concept of the apartment block, we excluded the group of price attributes: according to the previous researches, price could cause the substantial bias (Orme, 1996; Voelckner, 2006).

3. Research methodology and design

We assume that individuals simplify the choice process by categorizing the many attributes into logical subsets. Therefore we use hierarchical information integration as a basic method, which allows us to measure preferences by deducing the utility at the level of each attribute. To implement the hierarchical information integration we follow the research steps

proposed by Louviere and Timmermans (1990) with the modification of attributes and their levels. To provide the relevancy of attributes and levels for Russian real estate housing market we start from the series of expert interview, than develop conjoint cards called profiles (the main research instrument for HII) and after that proceed to the data collection an analysis. The received estimations we apply to evaluate the total utility of three apartment blocks offered in the high-price segment.

The steps of the research procedure are listed in the Table 1.

Table 1

Research procedure steps

Step	Research procedure	Result
Definition of the list of attributes and their levels	The series of expert interviews with 9 representatives of the development and building companies. Everyone has individually ranged the list of attributes grouped into logically untied subsets "Location", "Apartment Block", "Apartment", "Building Company".	The final list of 14 attributes, each having 2-4 levels, grouped into 4 subsets (see Table 4 in the Appendix 1).
Conjoint profiles (conjoint cards) development	For every subset a number of conjoint analysis cards, called profiles, was created. The profiles were created using orthogonal array method to minimize correlation between attributes and levels. According to Hugh (quoted by Yun, 2009) ten to twenty cards for one subset are generally considered to be appropriate for conjoint design.	16 conjoint cards for each subset (total – 64 cards) combining the attributes within the group at the level of quality, chosen randomly; 25 cards combining subsets at different levels.
Data collection	The purposive sample of 58 potential buyers (on the base of real estate agency) was created, 24% of the sample – the targeted segment of customers interested in high-price apartments. Respondents were to rank the profiles first within the subsets and then in-between subsets.	Individual preferences for the attributes and the subsets of attributes.
Data analysis	Data analysis was produced using Marketing Engineering add-ins for MS Excel. The estimations of various levels of attributes are calculated using the two-step linear regression analysis: first for the attributes within the subsets and them in-between the subsets.	Part-worth utilities of all the levels of each attribute. The sum of the 'best' level of all attributes gives 100.

The defined part-worth utilities are applied to three apartment blocks offered in the market to access their potential attractiveness for the target customers. The total utility estimations are compared with the current sales performance.

4. Findings

The purposive sample consisted of 58 respondents: these were potential customers, which enquired to the real-estate agency at the moment of research (April – May, 2012). All of them were looking for the apartment in a newly built apartment block. 24% of the respondents with monthly income more than 70 000 roubles were interested in the apartments of the high-price segment and thus were considered the target customers "apriori". The 'ideal' housing concept for this segment, consisting of the levels of attributes with the highest part-worth utility, is represented in Table 3.

Table 2

The ideal housing concept at the high-price segment based on consumer preferences of attributes characteristics

Attribute	Level	Level
Subset «Location"		**34,0**
Proximity to the city centre	central	24,6
Social infrastructure	plenty of objects of social infrastructure	4,9
Public transport availability	high	4,5
Subset «Aparment Block»		**15,6**
Building technology	brick	8,3
Building surrounding grounds	spacious	7,3
Subset «Apartment»		**34,4**
Apartment area	3 and more rooms, 100 or more sq.meters	23,7
Kitchen area	12 sq. meters and more	2,0
Design and finish	individual design and full-finish	8,7
Subset « Building Company»		**16,0**
Building company reputation	trustworty company	3,2
Timeline	meet the construction timeline	2,0
Type of property contract	share equity contract	4,0
Type of payment	partial compensation by secondary housing	1,0
Building stage	finishing stage	5,8
TOTAL UTILITY		**100,0**

Two subsets – "Location" and "Apartment" – contribute 68,8% to the total utility of the apartment; 31,4% of utility is influenced by the attributes of "Apartment Block" and "Building Company". In line with proximity to the city center and apartment area the attributes that adds significant value to the market offer are brick building technology, spacious apartment block surroundings and individual design and full finish of the apartment.

Along with the estimations of the most preferred attributes hierarchical information integration method gives the estimations for all the levels of each attribute. This gives us the possibility to relate consumer references to the current market offer. To illustrate this we have chosen three newly built apartment blocks (which are named AB_1, AB_2, AB_3 in the Table 3) and estimate their total utility applying the calculated part-worth utilities:

Table 3

Total utility of the housing objects offered at the high-price segment

Attribute	AB_1	AB_2	AB_3
Proximity to the city centre	24,6	24,1	24,6
Social infrastructure	3,5	4,9	3,6
Public transport availability	4,5	4,5	4,5
Building technology	6,6	8,3	8,3
Building surrounding grounds	2,4	7,3	7,3
Apartment area	23,7	23,7	19,6
Kitchen area	2,0	2,0	2,0
Design and finish	1,0	8,7	5,2
Building company reputation	3,2	3,2	3,2
Timeline	2,0	2,0	2,0
Type of property contract	4,0	4,0	0,6
Type of payment	0,2	0,2	1,0
Building stage	5,8	5,8	5,8
TOTAL UTILITY	**83,5**	**98,7**	**87,7**
Number of flats sold by 2008 (before crisis)	12 (10%)	67 (45%)	85 (43%)

None of the real estate housing objects offered to the market meet customers preferences' ideally. All the apartment blocks were constructed by the end of 2008 and offered at the high-price segment at the same price level. Measuring their utility as a multi-attribute product we see that different level of attributes adds different value. Consequently market demand reacts to the multi-attribute 'configuration' – this is evident when we compare the total utility to the sales performance indicators.

5. Discussion

The illustrative character of the example of information integration implementation provides the fruitful ground for further examination. The method could be helpful to solve the problems of market positioning, consumer segmentation and marketing mix adjustment. Our research faces some strong limitations like small sample size and lack of the R-square characteristics (which are not provided in the software we use). But the principal contribution of the approach we developed is the possibility of the attributes' estimations at the different stages of multi-attribute products development. In application to the real estate market this could give the developers the more accurate measures of consumer references thus improving their market offer and sales performance.

6. Key References

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Appendix 1

Subsets, attributes and their levels

Subset "Location"	
Attribute	**Levels**
Proximity to the city centre	Central
	Not far from centre
	Far from centre
	Suburb
Social infrastructure (schools, kindergarten, hospitals etc.) nearby	No social infrastructure
	Some social infrastructure objects
	Plenty of social infrastructure objects
Public transport availability	High
	Medium
	Low
Subset "Apartment Block"	
Building technology	Brick
	Panel
	Monolith concrete
	Other
Building surrounding grounds	Lack of building surrounding grounds
	Minimal surroundings
	Children playground and parking place
	Spacious building surrounding grounds
Subset "Apartment"	
Floor	Low
	Medium
	High
Apartment area	1 – 2 rooms, 45 sq. meters of less
	1 – 2 rooms, 45 – 65 sq. meters
	2 – 3 rooms, 66 – 99 sq. meters
	3 and more rooms, 100 or more sq. meters
Kitchen area	Less than 12 sq. meters
	12 sq. meters and more
Design and finish	Unfinished
	Standard design and half-finish
	Standard design and full-finish
	Individual design and full-finish
Subset "Building Company"	
Building company reputation	Trustworthy building company
	New to market building company
	Non-reliable building company
Timeline	Meet the construction timeline
	Do not meet the construction timeline
Type of property contract	Share equity contract
	Share accumulating contract
Type of payment	Money
	Partial compensation by previous housing
Building stage	"Ditch" – stage (initial)
	Construction stage
	Finishing stage
	Fully finalized house