Conjoint Predictions:
15 Years Later

1987

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Introduction

In November 1972, a series of papers on conjoint measurement was presented to the annual conference of the Association for Consumer Research. Among these papers was one (Fiedler, 1972) which discussed the application of conjoint measurement to the pricing and design of a pair of condominium towers being constructed on the New Jersey Palisades directly across the Hudson River from Manhattan.

The builder, Centex Homes, had begun selling units in 1971 for occupancy in late 1972.

Each of the two 31 story towers comprised a variety of apartments varying in size from three bedrooms-three bathrooms down to one bedroom-one bathroom. The initial pricing reflected the builder's experience in other projects: the larger the unit and the higher the floor, the more expensive the purchase price. Accordingly, units were priced in a range from $35,000 to $78,700 depending on size and floor. After a few weeks of sales, Centex realized that it had made serious mistakes in either the complex's design, its pricing, or both. Table 1 shows the results of these early sales.

Table 1

SALES IN BUILDING ONE (200 WINSTON DRIVE): 1/31/72

		Sold	
	Available	**#**	**%**
Plan A: 3BR Corner	124	13	10
Plan B: 2BR Corner	122	19	16
Plan C: 2BR Deluxe	122	25	20
Plan D: 2BR Regular	123	12	10
Plan E: 2BR Small	62	19	31
Plan F: 1BR	61	55	90
River View	338	121	36
No River View	276	22	8

Confounding the situation was the fact that the middle range of floors was selling much faster than the lower or upper units. Despite adjustments in pricing, the building continued to sell out unevenly.

Survey research in the construction industry in 1972 was as uncommon as it is today. But because the selling experience in the development was so contrary to Centex's experience, Market Facts, Inc., was commissioned to investigate what factors were producing the uneven sellout and what might be done to correct the current situation. Centex also wanted to prevent a comparable occurrence in the developer's second tower, soon to be constructed.

Market Facts 1972 Research Study

Market Facts recommended a study employing conjoint measurement, a technique which, until then, had been employed on a more or less experimental basis for Xerox Corporation. Aside from Market Facts' proprietary experiences with Xerox, evidence as to the applicability of conjoint measurement to marketing research had not been substantiated. Centex was understandably skeptical when the method was proposed to them. But a deal was quickly struck: Market Facts would conduct the study for a nominal fee if Centex would permit publication of a paper demonstrating the application of conjoint measurement to market research.

The research was fielded in the summer of 1972. A sample of 188 prospects was interviewed at the model apartments. The survey situation was ideal. Respondents qualified themselves by responding to sales advertisements for the development, and the model apartments' main features yielded comprehensive and distinct questionnaire stimuli. Only four attributes were necessary to describe all the apartments available:

Table 2

DESIGN OF MARKET FACTS 1972 RESEARCH

Layout	6 levels	Plans A through F
Price	10 levels	$46,000 to $82,000
Floor	4 levels	28^{th}, 20^{th}, 12^{th}, 4^{th}
View	2 levels	River view, no view

The measurement task was a simple one. A series of questionnaire grids was constructed, each showing pairings of all possible combinations. Respondents rank ordered their choices from most to least desirable. Given the simple design of the study, all possible pairings of attributes were included.

Findings of the 1972 Research

Neither the report prepared by Market Facts nor the data files remain, but the principal findings are well remembered by this author how has presented the case history many times since 1972. In brief, they are:

- Height premiums were not justified above the lowest tier of floors. The benefits of height are usually a better view and the absence of noise. In the case of Winston Towers, the quality of the view was not improved as a result of height and there was not a great deal of noise. On the contrary, higher floors resulted in longer elevator rides and little else.
- Utility values for larger apartments were proportionate to either purchase price of square footage. The additional rooms and amenities of the larger units were not worth the prices charged.
- View was significantly under-priced. This was no surprise given the sales results. What was surprising was that the spectacular view of Manhattan had, in the survey, an even greater value than might have been deduced from the pattern of sales.

The research recommended that the pricing of the first building be further modified by increasing the premium for the few remaining apartments with a view, by eliminating the floor premiums above the 12th floor, and by lowering the base prices of the larger apartments.

To assure a more even sellout of the second building, a pricing model was developed. Using Monte Carlo simulations, Market Facts was able to produce a pricing schedule which predicted an even sellout in the second building.

What Happened on the Palisades?

The design of Building Two was modified. While appearing quite similar to the first building, several key changes were incorporated. The east wing of the building was extended approximately 20 feet. Although the resulting design was less symmetrical than the first building, there were two important benefits. First, this design allowed more apartments with a view of the river. Second, the modified design permitted six, rather than four, apartments on each floor of the east wing. The new layout reflected what was selling: more corner and deluxe two bedroom apartments in place of the corner three bedroom apartments, and two more one bedroom units on each floor.

Table 3

TYPICAL FLOOR PLANS: WINSTON TOWERS

Unit	Building 1	Building 2
Plan A: 3BR Corner	4	2
Plan B: 2BR Corner	4	6
Plan C: 2BR Deluxe	4	6
Plan D: 2BR Regular	4	3
Plan E: 2BR Small	2	1
Plan F: 1BR	2	4

The author recalls that the developer did not charge as substantial a premium for the view as the conjoint pricing model suggested.

While both buildings are fully sold today, it is not known whether or nor the second building sold out more evenly than the first. On the basis of Building 2's floor plan alone, it is not unreasonable to surmise that it did.

1988 POPULUS Replication of 1988 Condominium Research

In early 1988, POPULUS undertook a research study to re-examine the Winston Towers condominiums from a conjoint measurement perspective. It was hoped to obtain the cooperation of the tenants' association and the condominium management to permit on-site interviewing, but no organization connected with Winston Towers was willing to cooperate with the research effort.

A limited program of research was designed to compare the Sawtooth Software ACA conjoint measurement approach with the earlier method. In addition, tax records for the two buildings were obtained showing the assessed value of each unit as well as the selling prices for 57 units sold from November, 1985 through December, 1986.

There were several key differences between the study conducted in 1972 and the current research:

- Interviewing Method
- 1972: Self-administered questionnaires, interviewer supervised in the sales office;
- 1988: Computer assisted telephone interviewing via WATS;
- Conjoint Measurement Model
- 1972: Market Facts proprietary application of Johnson's non-metric factor analysis;

- 1988: Sawtooth Software Adaptive Conjoint Analysis (ACA);
- Sample
- 1972: 188 Prospective buyers
- 1988: 100 Owner residents

Questionnaire Design

Attribute descriptions for unit types, floor level, and view were identical in both studies. Because of inflation, prices had to be adjusted. In the 1972 study, there were 10 price levels, in $3,000 increments, ranging from $46,000 to $82,000. In the 1988 study, there were 8 price levels, in $25,000 increments, ranging from $150,000 to $325,000. In the interview, the number of price levels any individual respondent saw was reduced to five using a "most likely" question. Three calibrating questions were utilized. After the ACA portion of the interview, respondents were asked to identify the unit number of their apartment, the building in which they lived, they year they purchased their apartment, and the price paid. Interviewing was conducted from March 4 to March 18, 1988.

Findings from 1988 Research

One of the most striking findings of the current study is the ease with which a conjoint measurement study can be fielded and the data analyzed. A process which took months fifteen years ago can be accomplished in weeks; a research procedure that was extremely costly then is extremely cost effective today. The respondent task is far easier and the computational procedures more effective.

Conjoint measurement permits a "goodness of fit" measure to be computed for each respondent's utility values. In 1972, the Market Facts procedure was to compare, on a pairwise basis, the rank orders of computed utilities with the respondent's raw data, using Kendall's tau. Sawtooth ACA reports the correlation between a respondent's purchase likelihoods for a series of concepts and the combined utilities for those concepts. While neither the procedures nor the measures are directly comparable, it is interesting to compare the results.

Table 4

COMPARISON OF "GOODNESS OF FIT" MEASURES

	Tau (1972)	**Correlation (1988)**
(Base)	**(188)**	**(100)**
	%	**%**
1.000	13	0
.950 - .999	27	64
.900 - .949	29	12
.850 - .899	14	9
.800 - .849	9	7
< .800	6	8

Mean utility values from the 1988 study are parallel to the author's remembered findings from the 1972 research. Again, units on the lowest range of floors are very undesirable. The value attached to a Hudson River view is very high. The relatively high desirability of the one bedroom apartments (Plan F) which were the first to sell out in 1972 is reflected in the 1988 data: these units, on average, are more highly valued than the small two bedroom units (Plan E).

Table 5

MEAN UTILITY VALUES: 1988 CONDOMINIUM RESEARCH

Attribute / Level	**Utiltiy**
Plan A: 3BR Corner	+ .52
Plan B: 2BR Corner	+ .10
Plan C: 2BR Deluxe	0.00
Plan D: 2BR Regular	-.37
Plan E: 2BR Small	-.60
Plan F: 1BR	-.49
River View	+ .54
No River View	-.58
28th Floor	+ .16
20th Floor	+ .20
12th Floor	+ .07
4th Floor	-.53
$325,00	-.65
$300,00	-.57
$275,00	-.42
$250,00	-.19
$225,00	+ .10
$200,00	+ .32
$175,00	+ .51
$150,00	+ .60

Validation

The 1988 research provided an opportunity to validate the application of conjoin measurement to condominium pricing by comparing the utility values owners ascribe to feature to the dollar value the market place ascribes to these same features.

To provide data for this comparison, it was first necessary to examine the Bergen County tax records for recent sales of Winston Towers units. From November, 1986 through December, 1987, 57 units were sold. From the unit and the building numbers corresponding to each sale, it was possible to determine the view, floor level, and plan for each unit sold. The sales prices were decomposed to determine the part-worth market values of each level of each attribute. This was done through a series of multiple regression analyses using dummy variables reflecting each level (less one) of each attribute.

The utility data were then rescaled to a dollar metric by regressing the mean utility values for each level of plan, floor, and price against the corresponding part-worth sales data. The function resulting from the regression ($UTIL = 64676.17*UTIL + 2664.89) was then applied to the utility values.

To make the resulting data more easily comparable, the value of the least desirable level of each attribute was set to zero and the remaining levels adjusted accordingly.

Table 6

COMPARISON OF RESCALED UTILITY VALUES WITH PART-WORTH SALES DATA ($000)

Attribute / Level	**Rescaled Utilities**	**Part-worth Sales Data**
Plan A: 3BR Corner	65	134
Plan B: 2BR Corner	38	93
Plan C: 2BR Deluxe	32	64
Plan D: 2BR Regular	8	30
Plan E: 2BR Small	7	19
Plan F: 1BR	0	0
River View	72	16
No River View	0	0
28th Floor	45	22
20th Floor	47	15
12th Floor	39	20
4th Floor	0	0
$325,00	69	
$300,00	74	
$275,00	84	
$250,00	99	
$225,00	117	
$200,00	132	
$175,00	144	
$150,00	150	

At first glance, this “best fit” rescaled comparison does not appear to be much of a fit at all. The conjoint model of rescale utilities has overestimated differences in attribute levels of view and floor and underestimated the effects of plan and price.

The model most accurately reflects the differences in floor level. In each case the 4th floor has considerably less value than any other floor. The range of differences across the top three tiers of floors is $8,000 for the rescaled utilities and $7,000 for the market values. Most of the distortion may be due to survey respondents "over rejecting" the lowest tier of floors.

Comparing the findings for the different plans reveals that the conjoint model consistently underestimates the value of each type of unit. Conjoint utilities fail to discriminate between the corner and deluxe two bedroom apartment and between the regular and the small two bedroom apartments. Further, all conjoint utilities underestimate the value of each unit.

The conjoint model overestimates the value of a river view by a factor of four. This is the greatest error in prediction. One hypothesis is that those residents who have river view apartments place a far greater value on view than do those who do not have such a view. Table 7 shows the utilities of view for each group. This psychological rationalization seems appropriate in light of their purchase choices.

Table 7

UTILITIES FOR VIEW BY RESIDENT APARTMENT

	Apartment	
Attribute / Level	**River View**	**No view**
River View	.61	.37
No view	-.64	-.44

While those living in river view apartments do have greater utilities for that view, the conjoint model would overestimate the market value for view even if the prediction were based on only those living in non-view apartments.

The last factor to be investigated was selling price. The utility values for purchase price are monotonically inversely related to price as one would expect. The rescaled dollar utility values may be thought of as the amount of money someone would pay to avoid spending a certain amount for a condominium. If the model were perfect, the dollar utilities would decline dollar-for-dollar as purchase price rise; they do not. The value of money spent is substantially underestimated.

Conclusions and Implications

It is too easy to review these analyses and conclude that the conjoint model is a weak predictor. While the model's errors are substantial, they are also understandable.

They appear to replicate the findings of the 1972 research. Centex was justified in its decision to implement price premiums significantly less "steep" than those suggested by the Market Facts model.

More importantly, the conjoint model overestimates the effects of those attributes which may be more emotionally laden, such as the benefits of a glorious view or the consequences of living on the lowest tier of floors. Correspondingly, the model under-predicts the more concrete attributes such as price and floor plan.

These methodological findings suggest that in the design of conjoint measurement research, there is great risk in attempting to measure across attributes, some of which are concrete descriptions and other of which are more benefit oriented. (See Reynolds, Fiedler, & Gutman, 1984.) It further suggests that there is still substantial work to be done to fine tune calibration procedures.

NOTES

Note: The author wished to acknowledge the assistance of Richard Miller of Consumer Pulse in conducting the field work for this research and Sheri Nadel of Marketing Perceptions for obtaining floor plans and tax and sales records for the Winston Tower condominiums.

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