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An Analysis of Theoretical Construction of Tenant Satisfaction Models for Long-Term Rental Apartments

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Abstract: This study centers on an in-depth discussion of the long-stay apartment tenant satisfaction model, which is constructed and validated by comprehensively applying a variety of modeling methods. In the research process, the latent variables of the long-stay apartment tenant satisfaction model are first identified by summarizing domestic and international satisfaction models. At the same time, based on marketing theory and the theory of inconsistent expectations, structural equation modeling (SEM) was constructed to describe the relationship between the latent variables, and specific models were built to verify the relevant assumptions through regression analysis. When determining the observation variables, we refer to ACSI, ECSI and other models, set the observation variables in combination with the characteristics of long-term rental apartments, and determine their weights by using the hierarchical analysis method (AHP). In addition, Combach α, compositional reliability, average refinement variance and other indicators are applied to test the reliability and validity, and the overall model fit is examined. The results of the study show a strong correlation between the latent variables and provide a clear direction of improvement for long term rental apartment companies.

Keywords: Structural Equation Modeling, ACSI Modeling, ECSI Modeling, Hierarchical Analysis.

1. Introduction

This paper focuses on the theoretical construction of the long-term rental apartment tenant satisfaction model[1]. Firstly, by summarizing domestic and international satisfaction models, the latent variables of the long-stay apartment tenant satisfaction model are identified, and the measurement methods of each latent variable are given. Then, based on marketing theory and satisfaction generation theory, hypothesize the correlation between the latent variables, construct structural equation modeling and set the hypothesis path and correlation impact[2]. Secondly, the ACSI model and ECSI model were synthesized to determine the observed variables of each latent variable, and the weights of the observed variables were determined using hierarchical analysis[3]. Finally, pre-survey was conducted on the basis of the established model, the sample size was determined according to the statistical formula, the data were analyzed by using SPSS and AMOS, and the reliability and validity test and the model fit test were conducted through a variety of indicators. According to the test results, the model is corrected and validated, and the path and degree of influence of the association are analyzed, aiming to provide a theoretical basis and policy recommendations for improving the satisfaction of long-term rental apartments[4].

2. Selection of latent variables

Latent variables are variables that cannot be obtained through direct measurement and need to be measured with the aid of other variables or indirectly. According to the domestic and foreign satisfaction model summary analysis can be summarized in the long-term rental apartment tenant satisfaction model of latent variables, namely, corporate image, tenant expectations, quality perception, value perception, tenant satisfaction, tenant complaints, tenant loyalty.

The “corporate image” of long-stay apartments is a comprehensive concept, covering brand awareness, brand reputation and other aspects. Brand awareness can be measured by the percentage of tenants who know the brand in the market research, calculated by the formula:

$$Brand\ Awareness = \frac{Number\ of\ tenants\ who\ know\ the\ brand}{Total\ number\ of\ tenants\ surveyed} \times 100\% \tag{1}$$

Brand reputation can be reflected by the proportion of tenants' positive comments on the brand, namely:

$$Brand\ Reputation = \frac{No.\ of\ tenants\ giving\ positive\ comments\ on\ the\ brand}{No.\ of\ tenants\ participating\ in\ the\ evaluation} \times 100\% \tag{2}$$

Introduce a brand value assessment model, such as the commonly used brand value = brand strength × brand revenue. In the long-stay apartment industry, brand strength can be composed of multiple dimensions such as brand awareness and brand loyalty.

Among them:

$$Brand\ Awareness = \frac{The\ number\ of\ tenants\ who\ know\ the\ brand}{The\ total\ number\ of\ potential\ tenants} \tag{3}$$

Brand loyalty can be approximated by renewal rate:

$$Renewal\ Rate = \frac{Number\ of\ tenants\ renewing\ their\ leases}{Number\ of\ tenants\ expiring} \times 100\% \tag{4}$$

Brand revenue mainly comes from rental income and additional service income, i.e.:

$$Brand\ Revenue = \frac{Gross\ Rental\ Revenue}{Gross\ Additional\ Service\ Revenue} \tag{5}$$

"According to the theory of expectation formation, tenant expectation can be expressed as follows:

$$\begin{aligned} Tenant\ Expectation &= Advertising\ Influence\ Factor \times Advertising\ Information \\ &+ Past\ Experience\ Influence\ Factor \times Past\ Renting\ Experience \\ &+ Others'\ Recommendation\ Influence\ Factor \times Others'\ Recommendation\ Information \end{aligned} \tag{6}$$

Among them, each influencing factor takes a value between 0 and 1, and its sum is 1. The specific value depends on how much importance the tenant attaches to different information sources. For example, tenants who emphasize on the quality of life may attach more importance to the information on apartment facilities in the advertisements, and their advertisement influence factor will be relatively high.

3. Analysis of correlation hypotheses

3.1. The hypothesis of tenant expectation correlation

According to the key idea of "expectation inconsistency theory" [5], the hypotheses of the latent variable "tenant expectation" are set as follows:

(1) Tenant expectations have a positive effect on perceived quality.

From the theoretical perspective, according to the Expectation-Confirmation Theory[6], the expectations formed by tenants before renting an apartment will affect their perception of the actual rental experience. From an empirical perspective, the following model is established through regression analysis of survey data from equal number of long-term rental apartment tenants:

$$Quality\ Perception\ Score = \alpha + \beta \times Tenant\ Expectation\ Score + \varepsilon \tag{7}$$

Where α is the intercept term, β is the regression coefficient, representing the degree of influence of tenant expectations on quality perception, and ε is the random error term. The β was derived from the data analysis and passed the significance test ($p < 0.05$), indicating that tenant expectation has a significant positive effect on quality perception.

Structural equation modeling (SEM) can be used to describe the relationship between latent variables in the satisfaction model of long-stay apartments, and its basic formula is:

$$\begin{aligned} &Endogenous\ Latent\ Variables = \\ &Coefficient\ Matrix \times Exogenous\ Latent\ Variables \\ &+ Residual\ Term \end{aligned} \tag{8}$$

Taking tenant expectation (exogenous latent variable) and quality perception (endogenous latent variable) as an example, assuming that the coefficient of the relationship is β_1, it can be expressed as:

$$\text{PerceivedQuality} = \beta_1 \times \text{Tenant Expectation} + \text{Residual Term} \tag{9}$$

If we consider the influence of multiple exogenous latent variables on quality perception, such as adding corporate image (exogenous latent variable), let its influence coefficient is β_2, the formula is expanded as:

$$\text{Perceived Quality} = \beta_1 \times \text{Tenant Expectation} + \beta_2 \times \text{Corporate Image} + \text{Residual Term} \tag{10}$$

(2) Tenant expectations have a positive effect on value perception.

(3) Tenant expectations have a positive effect on tenant satisfaction.

3.2. Quality perception correlation hypothesis

(1) Quality perception has a positive effect on price perception.

(2) Quality perception has a positive effect on tenant satisfaction.

3.3. Hypothesis of value perception

Value perception has a positive effect on tenant satisfaction.

3.4. Tenant satisfaction correlation hypothesis

(1) Tenant satisfaction has a negative effect on tenant complaints.

(2) Tenant satisfaction has a positive effect on tenant loyalty.

3.5. The hypothesis of tenant complaint correlation

Tenant complaints have a negative effect on tenant loyalty.

3.6. Corporate image related relationship hypothesis

(1) Corporate image has a positive effect on tenant expectations.

(2) Corporate image has a positive effect on perceived quality.

(3) Corporate image has a positive effect on tenant satisfaction.

According to the analysis as well as the practicality of the research, the potential variables are constructed on the basis of the satisfaction model of the long-term rental apartment, and at the same time, the structural equation model of the influencing factors of each aspect is constructed and the hypothetical paths and correlation impacts are set up as follows in Figure 1.

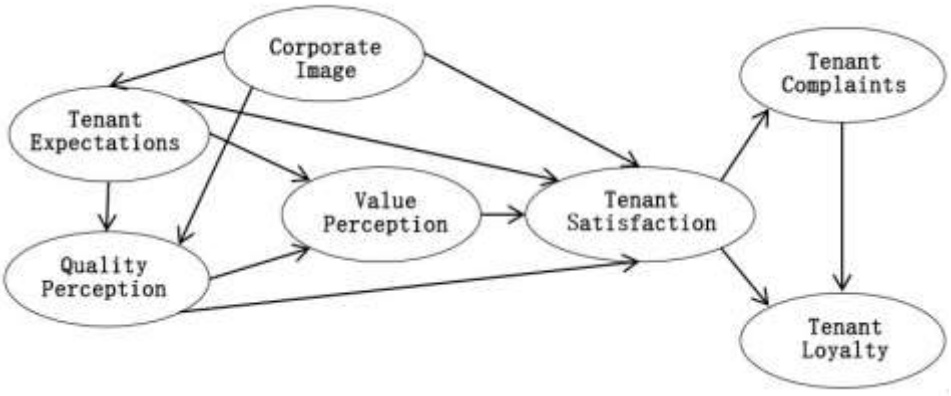

Figure 1. Hypothesized Paths and Associated Effects of Long-Term Apartment Satisfaction Modeling

4. Determination of observational variables

(1) Determination of Observational Variables for Tenant Expectations

Based on the ACSI model (American Customer Satisfaction Model) and ECSI model (Chinese Customer Satisfaction Model), the observed variables of the latent variable "tenant expectation" are: expectation of meeting individualized needs before renting, expectation of the basic quality of the apartment (reliability) before renting, and overall expectation of the apartment before renting. expectations before renting.

(2) Setting of observational variables for quality perception

Generally speaking, it is common to divide "quality perception" into multiple levels, such as architectural features, neighborhood environment, and location environment, in order to more accurately perceive and evaluate it.

The hierarchical analysis method (AHP) is used to determine the weights of the observed variables. Taking the observation variable of "quality perception" as an example, when constructing the judgment matrix, the observation variables such as "house type", "lighting and ventilation" and so on are compared two by two. The scoring is based on the 1-9 scale. If "house type" is considered to be slightly more important than "lighting and ventilation", the corresponding position in the judgment matrix is assigned a value of 3.

Let the judgment matrix be A. Calculate the maximum characteristic root $\lambda_{\max}$ and the eigenvector W to determine the weight of each observation variable. The consistency index calculation formula is:

$$\text{CI} = \frac{\lambda_{\max} - n}{n-1} \tag{11}$$

Where n is the matrix order. The random consistency index RI can be obtained by looking up the table, and the consistency ratio CR is calculated as:

$$\text{CR} = \frac{CI}{RI} \tag{12}$$

When $CR < 0.1$, the judgment matrix has satisfactory consistency. It is assumed that the weight of "house type" is calculated as w_1, and the weight of "lighting and ventilation" is calculated as w_2, etc. These weights reflect the relative

importance of the observed variables in measuring quality perception, which makes the determination of the observed variables more scientific.

In summary, this paper divides quality perception into four dimensions: built environment, neighborhood environment, location environment, and personalized community operation, and finally determines the observational variables of "quality perception" as shown in Table 1 below.

Table 1. Observational variables of "quality perception"

Dimension	Observed Variables
Built Environment	Floor Plan
	Light and Ventilation
	Area
	Interior Decoration Style
	Outdoor Design
	Home Facilities
	Utilities
	Security and Fire Protection
Neighborhood Environment	Property Management
	Environmental Hygiene and Greening
	Tenant Quality
Location	Public Facilities
	Transportation Accessibility
	Commuting Time and Cost
Personalized Community Operations	Community Activities
	Online operation (APP, Public)
	Community Care

(3) Setting Observation Variables for Value Perception

Based on the ACSI model, combining with the specific reality of long-term rental apartments, the observational variables of "price perception" are perception of quality under the same rent, perception of rent under the same quality conditions.

(4) Setting of observation variables of tenant satisfaction

In the ACSI model and the CCSI model, the observational variables of "satisfaction" are set as: overall satisfaction, the gap between actual and expected, and the gap between actual and ideal. In this paper, this setting is followed.

(5) Setting of Observable Variables for Tenant Complaints

In the ACSI model, it is considered that the observational variables can be set as follows: the number of informal complaints and the number of formal complaints, and in order to match with the other indicators, the number of overall complaints should be evaluated in a general way, so it is necessary to add "the number of complaints and the overall handling of the situation", taking into account the current status of domestic and international research and the treatment of most scholars. In addition, the study considered the number of formal and informal complaints to be the observational variable. To summarize, the observational variables for "tenant complaints" are the number of informal complaints and their handling, the number of formal complaints and their handling, and the number of overall complaints and their handling.

(6) Setting of observational variables for tenant loyalty

The ACSI model and the CCSI model are combined, and it is found that most of the potential variables of "tenant loyalty" are uniformly set as: the possibility of repeat purchases and the tolerance of price changes. However, the attributes of "long-term" and "rental" of long-stay apartments imply that there is a certain degree of mobility and the possibility of moving, so we can set 1 year as the time boundary, and split the "likelihood of repeat purchase" into the "likelihood of repeat purchase" and the "likelihood of tenant loyalty". It is possible to establish a time division of one year, splitting the "possibility of repeat purchase" into "possibility of re-renting in the next one year" and "possibility of re-renting after one year". In addition, "likelihood of recommending to friends and relatives" is also an observational variable that has been widely used and recognized in domestic and international studies. To summarize, the observed variables for the latent variable of "tenant loyalty" are the possibility of renting again in the next one year, the possibility of renting again after one year, the possibility of recommending to friends and relatives, and the ability to withstand price changes.

(7) Setting of observational variables for corporate image

Drawing on the CCSI model and the ECSI model, three indicators were selected as the observational variables of "corporate image": the overall evaluation of the corporate brand before renting, the evaluation of corporate integrity before renting, and the reputation and popularity of the company among the surrounding people; and the study took the corporate brand, corporate integrity, and customer participation as the observational variables of corporate image. The study takes corporate brand, corporate integrity, and customer involvement as the observation variables of corporate image. However, in fact, the observation variable of "customer participation" is interpreted as "tenant participation in corporate activities organized by the developer", but in the pre-survey, it is found that few users have this experience, so this indicator is deleted. To summarize, corporate brand, corporate integrity, and corporate reputation are selected as the observational variables of "corporate image".

5. Summary of model setting

The questionnaire was designed and pre-surveyed on the basis of the established long-stay apartment satisfaction model.

In the selection of research targets, stratified sampling was carried out according to the age, gender and geographical characteristics of long-stay apartment tenants. Considering that long-stay apartment tenants are mainly young people between the ages of 20 and 40, this age group was taken as the focus of the survey, while taking into account different genders and urban areas. The sample size was determined based on the statistical formula:

$$n = \frac{Z^2 \times p \times (1-p)}{e^2} \tag{13}$$

Where n is the sample size, Z is the quantile of the standard normal distribution (usually taken as 1.96, corresponding to a 95% confidence level), p is the expected overall proportion (usually taken as 0.5 to get the maximum sample size estimate), e is the allowable error margin (set according to the research precision requirements, such as 0.05).

The next idea of this paper is to modify the model and questionnaire according to the feedback of the pre-survey data, and formally distribute the questionnaire. After the data were collected, the data were analyzed by choosing with.

SPSS software is used for data entry and preliminary organization, including data cleaning (such as deleting duplicate data entry), outlier processing (such as identifying

and processing abnormal rent price data through box-and-line diagrams). Structural equation models were constructed in AMOS software, and the operation steps were as follows: firstly, draw the model diagram in the AMOS interface, connect the latent variables and observed variables; and then import the organized data for model estimation.

Combach a is used to measure the internal consistency reliability of the scale, and the calculation formula is:

$$\text{Combach a} = \frac{k}{k-1}\left(1 - \frac{\sum_{i=1}^{k}\sigma_i^2}{\sigma_T^2}\right) \tag{14}$$

Where k is the number of scale items, σ_i^2 is the variance of the score on item i, and σ_T^2 is the variance of the total scale score. It is generally considered that a Combach a value greater than 0.7 indicates good reliability of the scale.

The formula for calculating the component reliability is:

$$\text{CR} = \frac{\left(\sum_{i=1}^{n}\lambda_i\right)^2}{\left(\sum_{i=1}^{n}\lambda_i\right)^2 + \sum_{i=1}^{n}\theta_i} \tag{15}$$

Where λ_i is the standardized loadings of the observed variables and latent variables, θ_i is the measurement error variance of the observed variables, and n is the number of observed variables, which ideally should be greater than 0.6.

The average refining variance is calculated as:

$$\text{AVE} = \frac{\sum_{i=1}^{n}\lambda_i^2}{\sum_{i=1}^{n}\lambda_i^2 + \sum_{i=1}^{n}\theta_i} \tag{16}$$

A value greater than 0.5 indicates that the model has good convergence validity.

The validity test was conducted using $Cornbach\,\alpha$, the convergent reliability test was conducted based on two indicators, namely, the component reliability and the mean refining variance, while the differential reliability test was conducted using the mean refining variance method, and then the overall model fit test was conducted based on χ^2/df、RMR、RMSEA、GFI and other indicators.

χ^2/df (chi-square degrees of freedom ratio) is an important indicator of model fit, calculated as:

$$\chi^2/df = \frac{\chi^2}{df} \tag{17}$$

Where, χ^2 is the chi-square value, df is the degrees of freedom, generally take the value between 1-3 model fit better.

RMR (root mean square of residuals) is calculated as:

$$\text{RMR} = \sqrt{\frac{\sum_{i=1}^{p}\sum_{j=1}^{p}\left(r_{ij} - \hat{r}_{ij}\right)^2}{p(p+1)/2}} \tag{18}$$

Where, r_{ij} is the correlation coefficient of the observed data, $\hat{r}_{ij}$ is the correlation coefficient estimated by the model, p is the number of variables, the smaller the value of RMR, the better the model fit, usually less than 0.05 means a good fit.

$RMSEA$ (root mean square of approximation error) is calculated as:

$$\text{RMSEA} = \sqrt{\frac{\chi^2 - df}{df(n-1)}} \tag{19}$$

Where n is the sample size, less than 0.08 means the model fits reasonably well, and less than 0.05 means it fits very well.

The GFI (Goodness of Fit Index) is calculated as:

$$\text{GFI} = 1 - \frac{\sum_{i=1}^{p}\sum_{j=1}^{p}\left(s_{ij} - \hat{s}_{ij}\right)^2}{\sum_{i=1}^{p}\sum_{j=1}^{p}s_{ij}^2} \tag{20}$$

Where s_{ij} is the sample covariance, $\hat{s}_{ij}$ is the estimated covariance of the model, the range of values 0-1, the closer to 1 the better the fit, generally greater than 0.9 indicates a better fit.

If the model fit is poor, such as the value of χ^2/df is greater than 3, it is necessary to check the model settings, adjust the relationship between the observed variables and the latent variables or add new observed variables, re-estimate and test, until the ideal fit is achieved.

Finally, the model is corrected and validated to obtain the path coefficients and hypothesis validation of the structural equation model, analyze the several paths of the correlation influence, and analyze the degree of influence, and put forward specific policy recommendations to improve the satisfaction of long-term rental apartments.

6. Conclusions

This paper comprehensively utilizes various methods such as model construction and empirical analysis method to carry out the research. By summarizing domestic and international satisfaction models, we determine the latent variables of the long-stay apartment tenant satisfaction model; using the model construction method, we put forward hypotheses on the relationship between the latent variables based on theories related to marketing and satisfaction, construct a structural equation model, and at the same time, the hierarchical analysis method is used to determine the weights of the observed variables; using the empirical analysis method, we carry out a pre-survey and analyze the data by using SPSS and AMOS to test the reliability, validity, and fit of the model through a variety of indicators, and modify and verify the model according to the test results. A variety of indicators were used to test the reliability, validity and fit of the model, and the model was revised and validated according to the test results. The study aims to provide a useful reference for the development of the long-stay apartment industry through comprehensive and in-depth research.

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