

Data Analysis of listing_Shanghai from Airbnb

Song Xiaodong, Niu Shengjie, Pei Yankai, Yuan Haocheng

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Introduction

Introduction

1. Background

- Airbnb was founded in August 2008 and is headquartered in San Francisco, California. Airbnb is a travel rental community that allows users to publish, search and book vacation rentals online or via a mobile app. Our data set contains the basic information of Shanghai Airbnb housing.

Introduction

1. Objectives

- Objective 1: The price of a house
- Objective 2: The factors that affect user's review scores rating

Data Preprocessing

Data Preprocessing

1. Data cleaning

- The original data has a total of **29,159** observations and 59 features.
- Observe overall missing values:

1	name	1
2	description	1160
3	neighborhood_overview	4509
4	host_since	2
5	host_response_time	5015
6	host_response_rate	5015
7	host_acceptance_rate	3456
8	host_is_superhost	2
9	host_total_listings_count	2
10	host_identity_verified	2
11	bathrooms_text	55
12	bedrooms	1087

13	beds	308
14	first_review	11372
15	last_review	11372
16	review_scores_rating	11372
17	review_scores_accuracy	11880
18	review_scores_cleanliness	11880
19	review_scores_checkin	11882
20	review_scores_communication	11880
21	review_scores_location	11883
22	review_scores_value	11883
23	reviews_per_month	11372

- For features with few missing values, we directly delete these observations. There are 27784 observations left after deletion.

Data Preprocessing

1. Data cleaning

- Remove 3 observations with a price of 0:

	bathrooms_text	bedrooms	beds	amenities	price	minimum_nights	maximum_nights	minimum_minimum_nights
0		NA	NA	["Airport shuttle", "Restaurant", "Long term stays allo...]	0.00	1	1095	1
0		NA	NA	["Restaurant", "Long term stays allowed", "Laundry ser...]	0.00	1	1095	1
5	3 baths	4	4	["Iron", "Smoke alarm", "Heating", "Breakfast", "Hanger...]	0.00	365	1125	365

- The variable `price` is currency data, we removed the '\$' and ',' symbols in the data, and converted into a numerical value. And variables `host_response_rate` and `host_acceptance_rate` are also text data, remove the '%' symbol and convert them to numerical values.
- For feature `amenities`: remove all symbols like '\u2019s' by `regular expression` to get all the amenities that have appeared, a total of 255.

a full one bedroom flat with living, dinning and balcony, full kitchen of all amenities, and bathroom w/shower. Wash ma restaurants and nightlife zone within walking distance. New night scene of Yong Kang road, old traditional triangle of D dropoff allowed", ""Children\u2019s books and toys"", ""Building staff"", ""Hair dryer"", ""Room-darkening shades"", d to the room, it can accommodate 3 people. There is also a fully functional kitchen. The bathroom and the shower ro our own apartment.. also a lot of restaurants, if u want to taste chinese food u could go around and check which one u

Data Preprocessing

1. Data cleaning

- We do not select all the features that have appeared, we choose to extract the amenities that appear more than 1000 times in all observations, and convert these facilities into dummy variables, that is, 74 columns of dummy variables are added to the original data set.

```
1 the top 0 is Air conditioning, it appears 27083 times
2 the top 1 is Wifi, it appears 26824 times
3 the top 2 is Long term stays allowed, it appears 26444 times
4 the top 3 is Hair dryer, it appears 25524 times
5 the top 4 is Shampoo, it appears 25009 times
6 the top 5 is Essentials, it appears 24271 times
7 the top 6 is Hangers, it appears 23685 times
8 the top 7 is Washer, it appears 23204 times
9 the top 8 is Hot water, it appears 20503 times
10 the top 9 is Fire extinguisher, it appears 19404 times
11 the top 10 is TV, it appears 19069 times
12 ...
13 the top 71 is High chair, it appears 1139 times
14 the top 72 is Board games, it appears 1083 times
15 the top 73 is Childrens dinnerware, it appears 1040 times
16 the top 74 is Waterfront, it appears 989 times
```



Extra pillows and blankets	Iron	Smoke alarm	Oven	Heating	Bed linens	Hangers	Kitchen
1	1	1	1	1	1	1	1
0	1	1	0	0	0	1	1
0	1	1	0	1	0	1	1
0	1	1	0	1	0	1	1
0	1	1	0	1	0	1	1
0	1	1	0	1	0	0	0
1	1	1	0	0	1	1	1
0	0	0	0	1	0	1	1
0	1	0	1	1	1	1	1

We filter for amenities with similar meanings. There are 71 dummy variables left representing different amenities.

Data Preprocessing

2. Feature Engineering

- For feature `bathroom_text`:

Entire: 15976																		
0 baths	1 bath	1.5 baths	10 baths	10.5 baths	11 baths	11.5 baths	12 baths	12.5 baths	13 baths	13.5 baths	14 baths	14.5 baths	15 baths	15.5 baths				
19	10967	1415	92	16	44	11	33	12	26	5	9	1	9	1				
16 baths	16.5 baths	17 baths	17.5 baths	18 baths	19 baths	2 baths	2.5 baths	20 baths	21.5 baths	23 baths	24 baths	3 baths	3.5 baths	4 baths				
6	7	2	1	1	3	1167	134	2	1	1	1	1	418	60	278			
4.5 baths	5 baths	5.5 baths	6 baths	6.5 baths	7 baths	7.5 baths	8 baths	8.5 baths	9 baths	9.5 baths	Half-bath							
73	227	55	181	52	132	36	201	35	73	14	155							

Private: 11204																	
0 baths	0 shared baths	1 bath	1 private bath	1 shared bath	1.5 baths	1.5 shared baths	10 baths	10 shared baths									
11	32	1572	5261	1950	799	584	24	5									
10.5 baths	10.5 shared baths	11 baths	11.5 baths	12 baths	12 shared baths	12.5 baths	13 baths	13 shared baths									
1	1	5	1	7	2	4	2	1									
13.5 baths	13.5 shared baths	14.5 baths	15 baths	15 shared baths	15.5 baths	16 baths	16 shared baths	16.5 baths									
2	1	1	2	2	1	1	2	1									
18.5 baths	19.5 baths	2 baths	2 shared baths	2.5 baths	2.5 shared baths	20 baths	21 baths	22 baths									
1	1	222	120	17	24	1	1	1									
3 baths	3 shared baths	3.5 baths	3.5 shared baths	4 baths	4 shared baths	4.5 baths	4.5 shared baths	5 baths									
99	44	9	5	33	14	9	5	23									
5 shared baths	5.5 baths	5.5 shared baths	50 baths	6 baths	6 shared baths	6.5 baths	6.5 shared baths	7 baths									
8	8	4	1	30	6	5	5	13									
7 shared baths	7.5 baths	7.5 shared baths	8 baths	8 shared baths	8.5 baths	8.5 shared baths	9 baths	9 shared baths									
5	5	2	32	2	6	1	9	3									
9.5 baths	Half-bath	Private half-bath	Shared half-bath	62													
2	73	22	62														

Shared: 604									
0 shared baths	1 shared bath	1.5 shared baths	2 shared baths	2.5 shared baths	3 shared baths	3.5 shared baths	4 shared baths	4.5 shared baths	
5	433	66	55	10	12	2	7	1	
5 shared baths	7 shared baths	Shared half-bath							
4	4	5							

No full bathroom: 174
1 bathroom: 12382
2 bathroom: 1301
3 bathroom: 478
4 or more: 1641

 No full bathroom: 200
1 private bathroom: 6060
1 share bathroom: 4106
2 bathroom: 383
3 bathroom: 157
4 or more: 298

No full bathroom: 10
1 bathroom: 499
2 bathroom: 65
3 or more: 30

Data Preprocessing

2. Feature Engineering

- For feature `property_type`:

Barn 1	Camper/RV 3	Campsite 1	Castle 3	Earth house 7
Entire bed and breakfast 5	Entire bungalow 23	Entire cabin 12	Entire chalet 9	Entire condominium (condo) 1515
Entire cottage 120	Entire guest suite 38	Entire guesthouse 28	Entire home/apt 4	Entire hostel 1
Entire loft 1499	Entire place 9	Entire rental unit 6823	Entire residential home 2056	Entire resort 2
Entire serviced apartment 1317	Entire townhouse 163	Entire villa 2030	Farm stay 198	Floor 3
Kezhan 3	Minsu 4	Nature lodge 1	Pension 1	Private room 10
Private room in barn 2	Private room in bed and breakfast 350	Private room in bungalow 21	Private room in cabin 9	Private room in casa particular 4
Private room in castle 4	Private room in chalet 3	Private room in condominium (condo) 547	Private room in cottage 192	Private room in dome house 1
Private room in earth house 6	Private room in farm stay 414	Private room in guest suite 33	Private room in guesthouse 75	Private room in hostel 107
Private room in kezhan 482	Private room in loft 207	Private room in minsu 11	Private room in nature lodge 5	Private room in ranch 1
Private room in rental unit 1864	Private room in residential home 1534	Private room in resort 124	Private room in serviced apartment 849	Private room in tent 4
Private room in tiny house 16	Private room in townhouse 267	Private room in villa 3364	Private room in yurt 1	Ranch 2
Religious building 1	Riad 1	Room in apartment 107	Room in boutique hotel 377	Room in hotel 266
Shared room 1	Shared room in apartment 2	Shared room in barn 1	Shared room in bed and breakfast 8	Shared room in boutique hotel 12
Shared room in bungalow 1	Shared room in casa particular 1	Shared room in condominium (condo) 77	Shared room in farm stay 3	Shared room in guest suite 5
Shared room in guesthouse 13	Shared room in hostel 140	Shared room in kezhan 1	Shared room in loft 20	Shared room in rental unit 234
Shared room in residential home 41	Shared room in serviced apartment 9	Shared room in tent 4	Shared room in townhouse 11	Shared room in villa 20
Tent 17	Tiny house 22	Treehouse 1		

- 
1. 复式 Loft
 2. 公寓 Apartment
 3. 精品酒店 Boutique Hotel
 4. 别墅 Villa
 5. 客栈 Kezhan
 6. 酒店 Hotel
 7. 住宅 House
 8. 度假村 Resort
 9. 乡野民宿 Homestay
 10. 农家乐 Agritainment
 11. 度假木屋 Cabin
 12. 露营地 Campsite
 13. 帐篷 Tent
 14. 树屋 Treehouse

Data Preprocessing

2. Feature Engineering

- Add variable: **availability**

has_availability	availability_30	availability_60	availability_90	availability_365
t	0	21	51	326
t	0	25	55	330
t	6	6	6	275
t	0	0	0	236
t	0	0	0	49
t	15	45	75	350
t	24	54	84	359
t	28	58	88	363
t	30	60	90	365
t	29	59	89	364



Feature: availability
Available in 30 days
Available in 60 days
Available in 90 days
Available in 365 days
Not Available

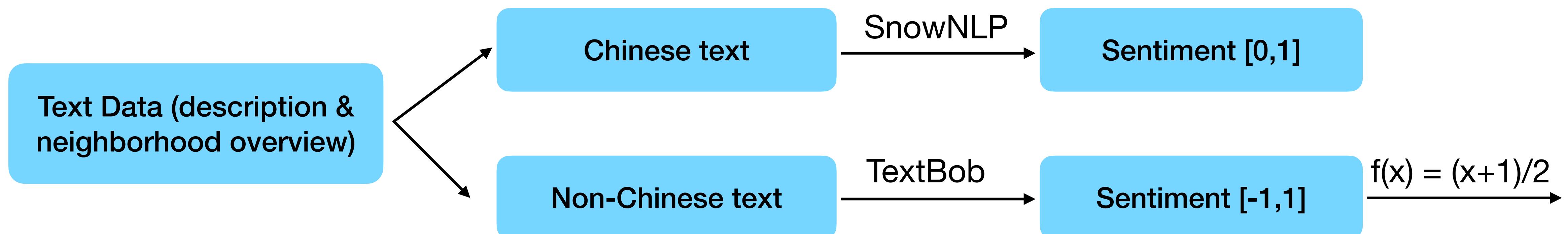
Data Preprocessing

3. Sentiment Analysis

- For 2 complex text data: description(1099) & neighborhood_overview(4368)

Compared to whether the description and the neighborhood overview specifically mention some things, what can best reflect the difference between different listings is the activeness of the host's introduction to the listing.

We hope that the text can be converted into a value **between 0 and 1** through sentiment analysis to represent the host's positivity for this listing.



Data Preprocessing

4. Sufficient Dimensionality Reduction

Check in



Bathroom



Security

-
- A red circle containing a list of security-related features:
- Fire extinguisher
 - Smoke alarm
 - First aid kit
 - Carbon monoxide alarm

-
- A purple circle containing a list of basic amenities:
- Lockbox
 - Clothing storage
 - EV charger
 - Pool
 - Air conditioning
 - Wifi
 - Essentials
 - Hangers
 - Hot water
 - TV
 - Dedicated workspace
 - Heating
 - Iron
 - Bed linens
 - Lock on bedroom door
 - Stove
 - Room-darkening shades
 - Extra pillows and blankets
 - Backyard
 - Ethernet connection
 - Smart lock
 - Patio or balcony
 - Gym
 - Window guards
 - Security cameras on property
 - Children books and toys
 - Indoor fireplace
 - High chair
 - Board games

Basic

Data Preprocessing

4. Sufficient Dimensionality Reduction

Another easier understanding expression is similar to the orthogonal factor model of covariates conditional on responder

$$\mathbf{X}_y = \boldsymbol{\mu} + \mathbf{A}\mathbf{f}_y + \boldsymbol{\epsilon}$$

where $\mathbf{X}_y = \mathbf{X}|y$, \mathbf{A} is the loading matrix fixed and to be estimated, $\mathbf{f}_y = \mathbf{f}|y$ is the factor conditional on y , \mathbf{X} 's are independent and $\mathbf{X} \perp \boldsymbol{\epsilon}$, $\boldsymbol{\epsilon} \sim (\mathbf{0}, \Delta)$.

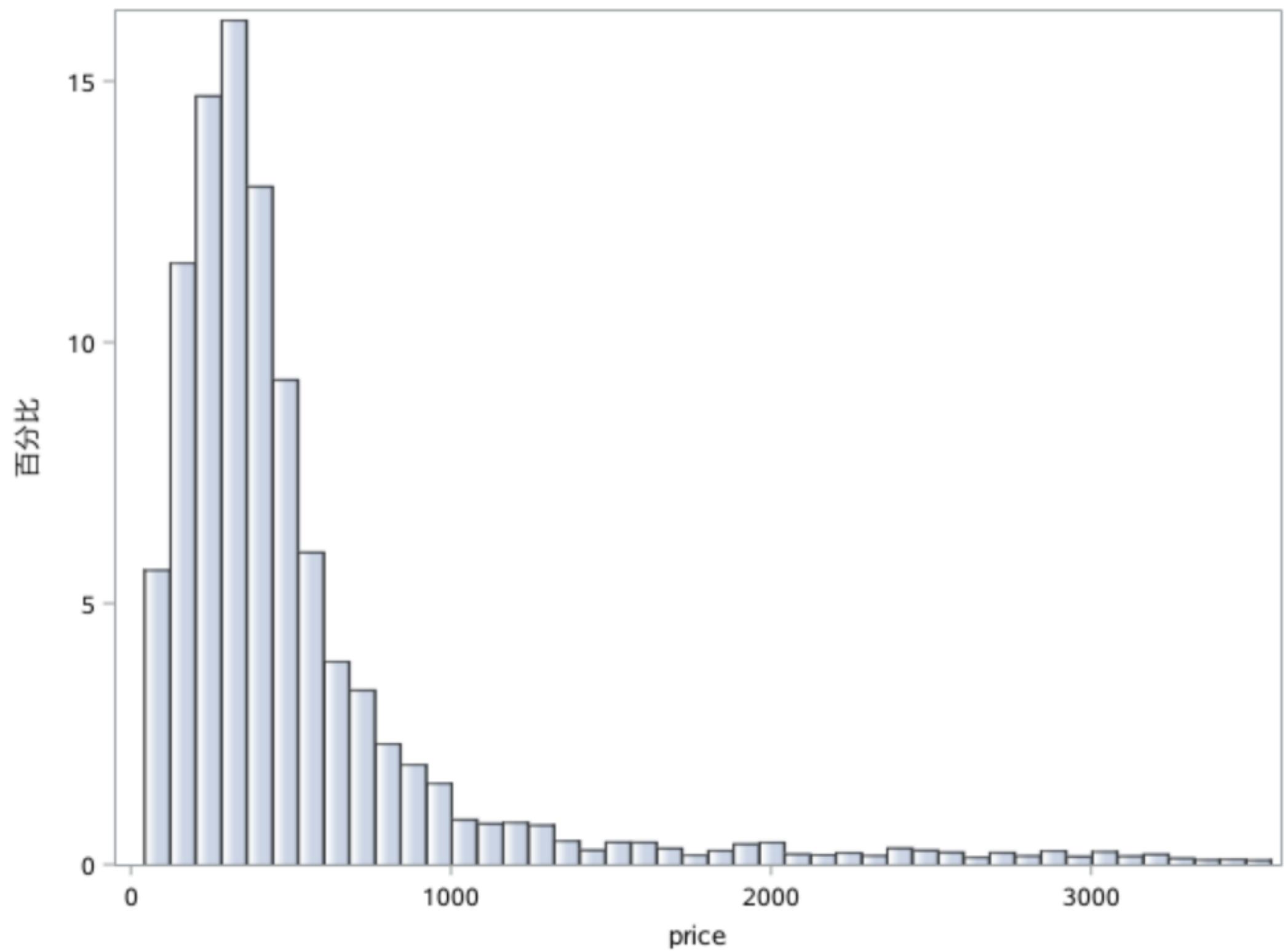
- Therefore, we transformed the 71 columns of dummy variables we added earlier into five-aspect score values.
- And normalize the scores of these five aspects.
- We still have **27784** observations left in our data after preprocessing

Checkin	Basic	Bathroom	Kitchen	Security
0.44941476	0.39234364	0.42999202	0.29326681	0.08125693
0.52296751	0.44042802	0.42999202	0.32797982	0.50495434
0.52296751	0.49971264	0.42999202	0.26327031	0.50495434
0.52296751	0.50510969	0.42999202	0.23733915	0.50495434
0.52296751	0.50510969	0.42999202	0.21712379	0.50495434
0.49708546	0.55777989	0.64072503	0.23733915	0.50495434
0.69207848	0.53538265	0.38669617	0.26327031	0.50495434

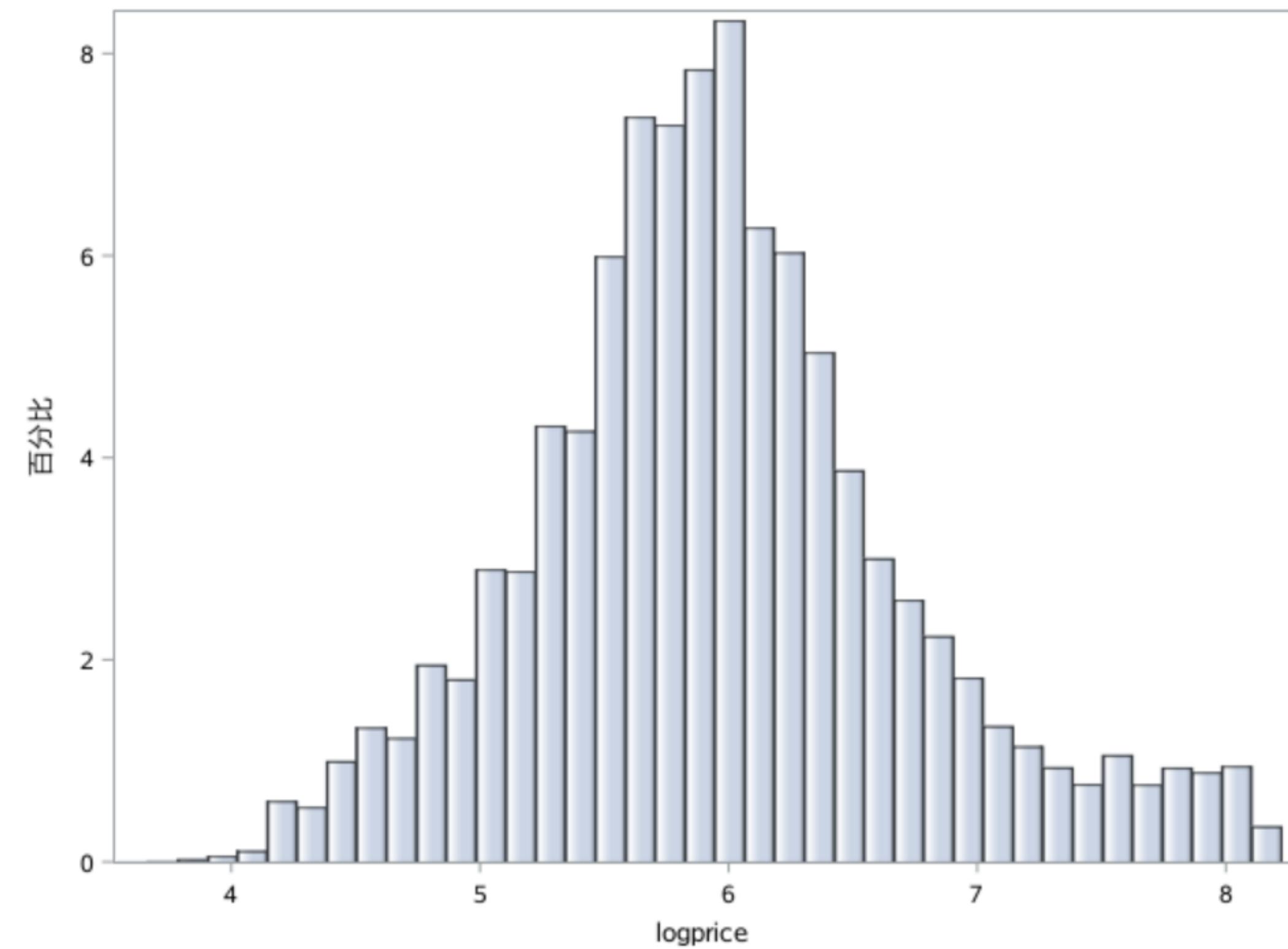
Data Analysis

Data Analysis

1. Exploratory Data Analysis

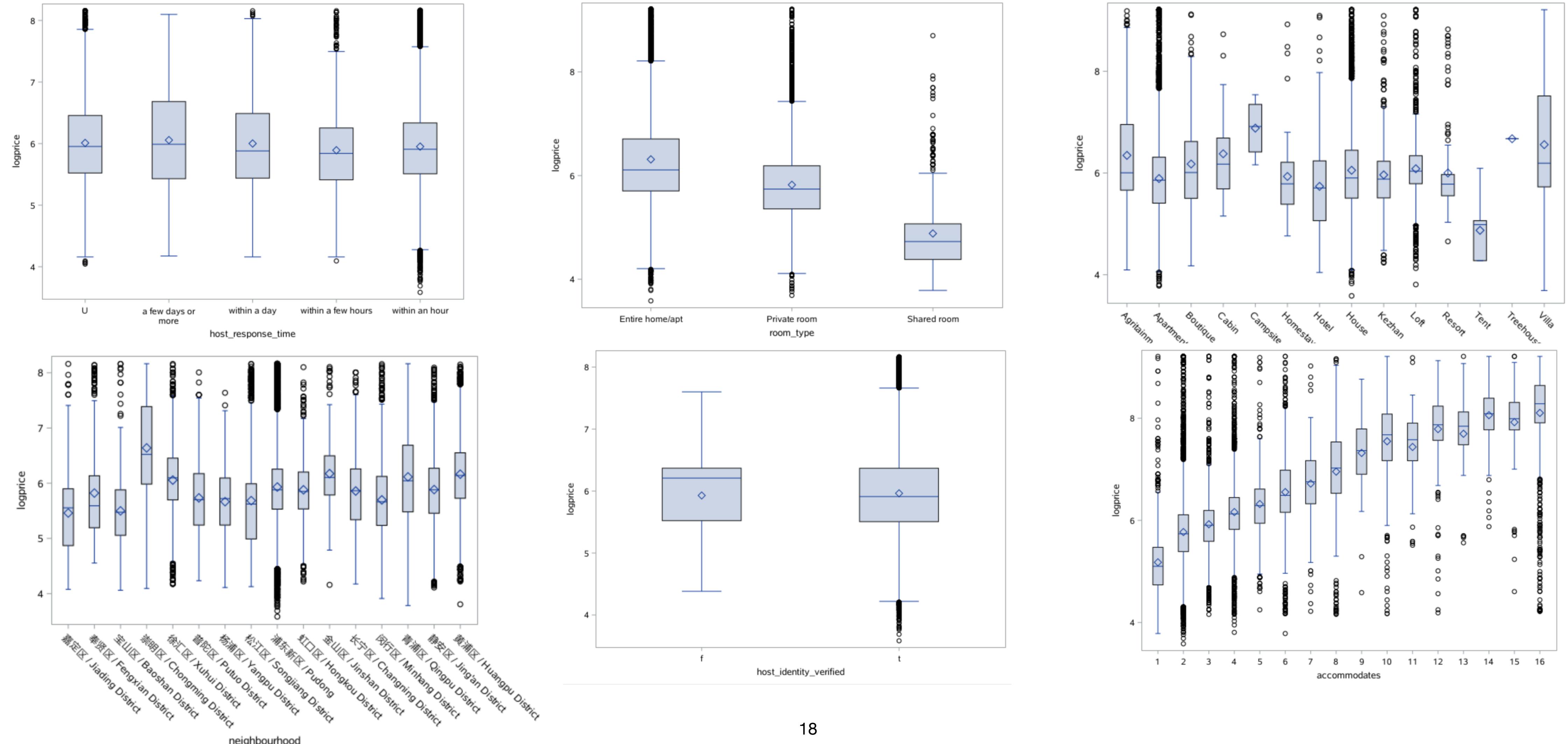


Log →



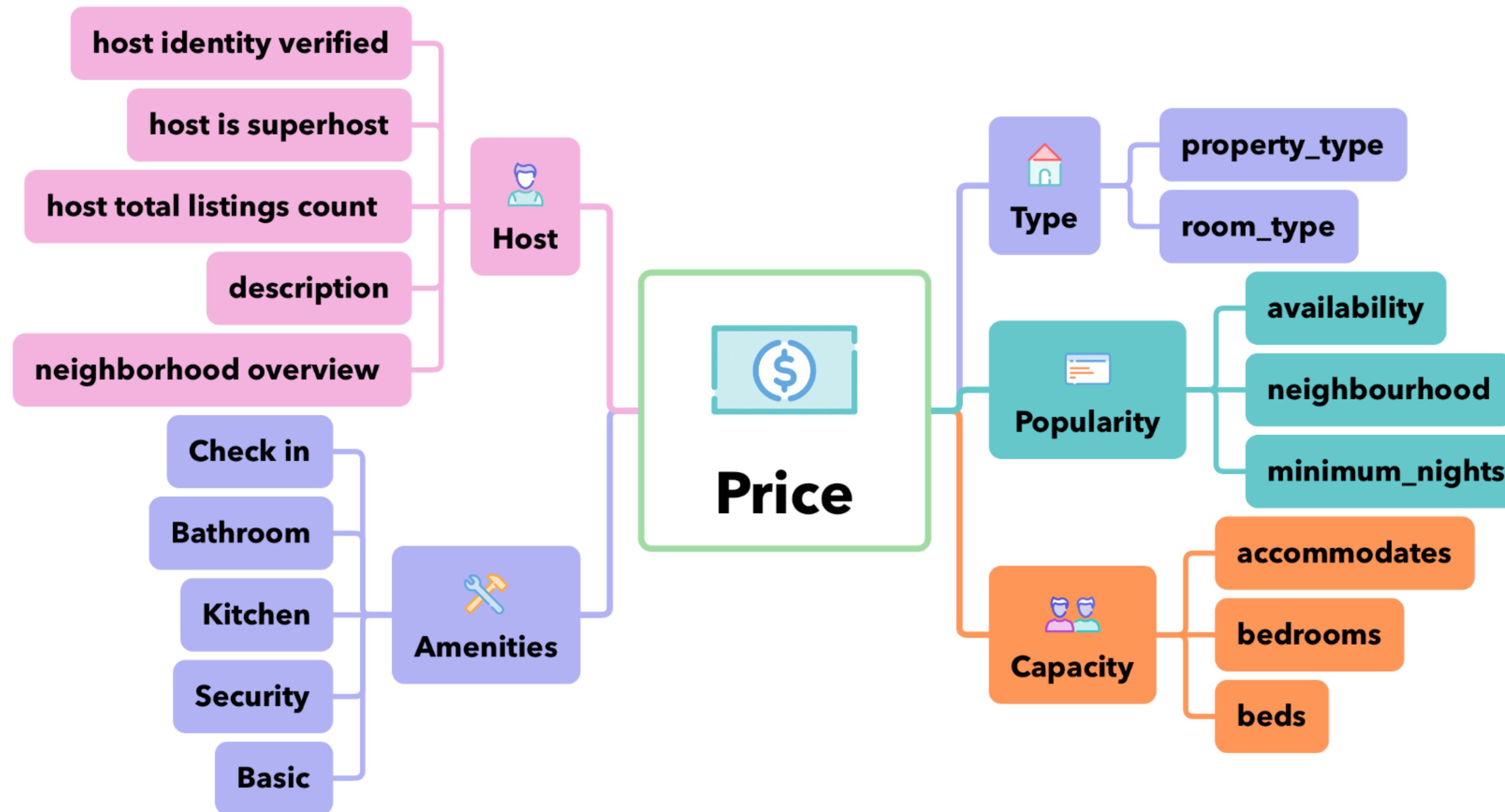
Data Analysis

Exploratory Data Analysis



Data Analysis

Price Analysis: Choice of explanatory variables



Data Analysis

Price Analysis: Variable correlation detection

Pearson 相关系数, N = 27783									
description	description	neiover	logprice	host_total_listings_count	Kitchen	Bathroom	bedrooms	Security	
	1.00000	0.12206	0.04495	-0.03637	-0.01570	-0.01108	0.01104	0.01035	
neiover		1.00000	0.12206	0.06526	minimum_nights	Basic	Bathroom	Checkin	host_total_listings_count
Checkin		1.00000	host_total_listings_count	0.29371	Bathroom	logprice	Kitchen	accommodates	Basic
Basic		1.00000	logprice	-0.36488	accommodes	Kitchen	bedrooms	beds	Checkin
Bathroom		1.00000	Basic	-0.26136	Checkin	logprice	minimum_nights	Security	host_total_listings_count
Kitchen		1.00000	Basic	0.26411	accommodes	beds	bedrooms	Checkin	Security
Security		1.00000	Checkin	0.19619	Kitchen	Bathroom	Basic	logprice	0.19619
minimum_nights		1.00000	Bathroom	-0.07416	Checkin	logprice	accommodes	bedrooms	beds
accommodes		1.00000	beds	0.84171	bedrooms	-0.06711	-0.06200	neiover	Basic
bedrooms		1.00000	beds	0.85028	accommodes	0.67405	-0.36488	-0.05897	0.05315
beds		1.00000	beds	0.85028	bedrooms	0.61064	Basic	Kitchen	Checkin
logprice		1.00000	accommodes	0.67405	accommodes	0.55764	-0.28707	0.26411	0.19739
host_total_listings_count	host_total_listings_count	1.00000	Checkin	-0.30086	Bathroom	beds	Basic	Bathroom	Kitchen
						0.55764	-0.41192	0.26132	-0.24528
						0.12841	-0.11686	-0.09179	0.22328
							0.04794	-0.09137	0.13049
								0.04794	-0.04017

Data Analysis

Price Analysis: Detection of multicollinearity

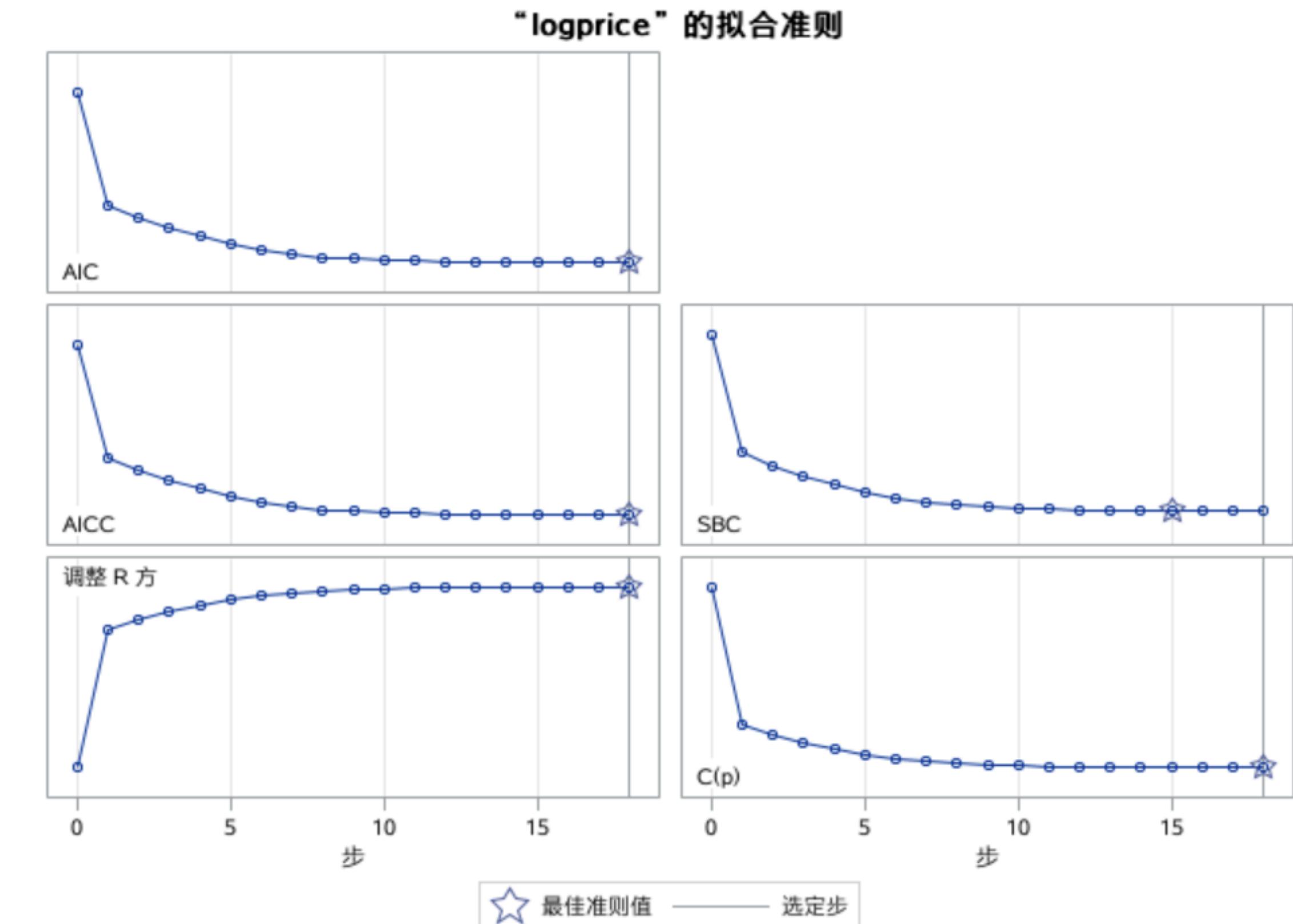
参数估计							
变量	自由度	参数估计	标准误差	t 值	Pr > t	容差	方差膨胀
Intercept	1	6.24224	0.03543	176.18	<.0001	.	0
description	1	0.09196	0.00877	10.48	<.0001	0.98188	1.01846
neiover	1	-0.00804	0.00998	-0.81	0.4207	0.97268	1.02808
Checkin	1	0.47872	0.02830	16.92	<.0001	0.77228	1.29486
Basic	1	-1.26634	0.04004	-31.62	<.0001	0.75398	1.32630
Bathroom	1	-0.68211	0.02986	-22.85	<.0001	0.81931	1.22054
Kitchen	1	-0.14590	0.03395	-4.30	<.0001	0.83416	1.19882
Security	1	-0.07928	0.01348	-5.88	<.0001	0.87721	1.13998
minimum_nights	1	0.00001952	0.00012906	0.15	0.8798	0.93966	1.06422
host_total_listings_count	1	-0.00078510	0.00005284	-14.86	<.0001	0.89206	1.12100
accommodates	1	0.14726	0.00238	61.85	<.0001	0.23092	4.33055
bedrooms	1	0.11434	0.00446	25.63	<.0001	0.23185	4.31321
beds	1	-0.04748	0.00310	-15.34	<.0001	0.21522	4.64644

Data Analysis

Price Analysis: Stepwise regression

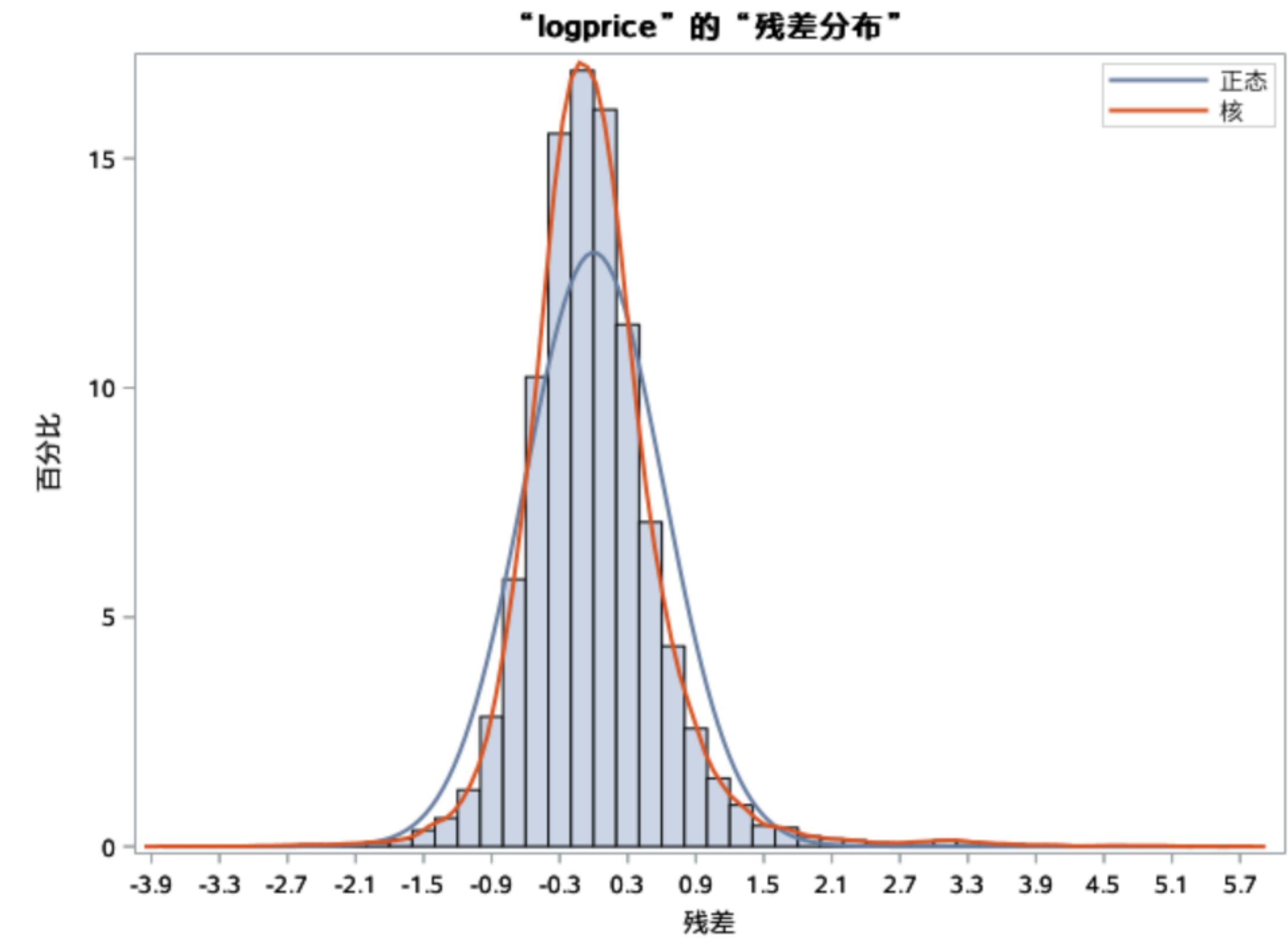
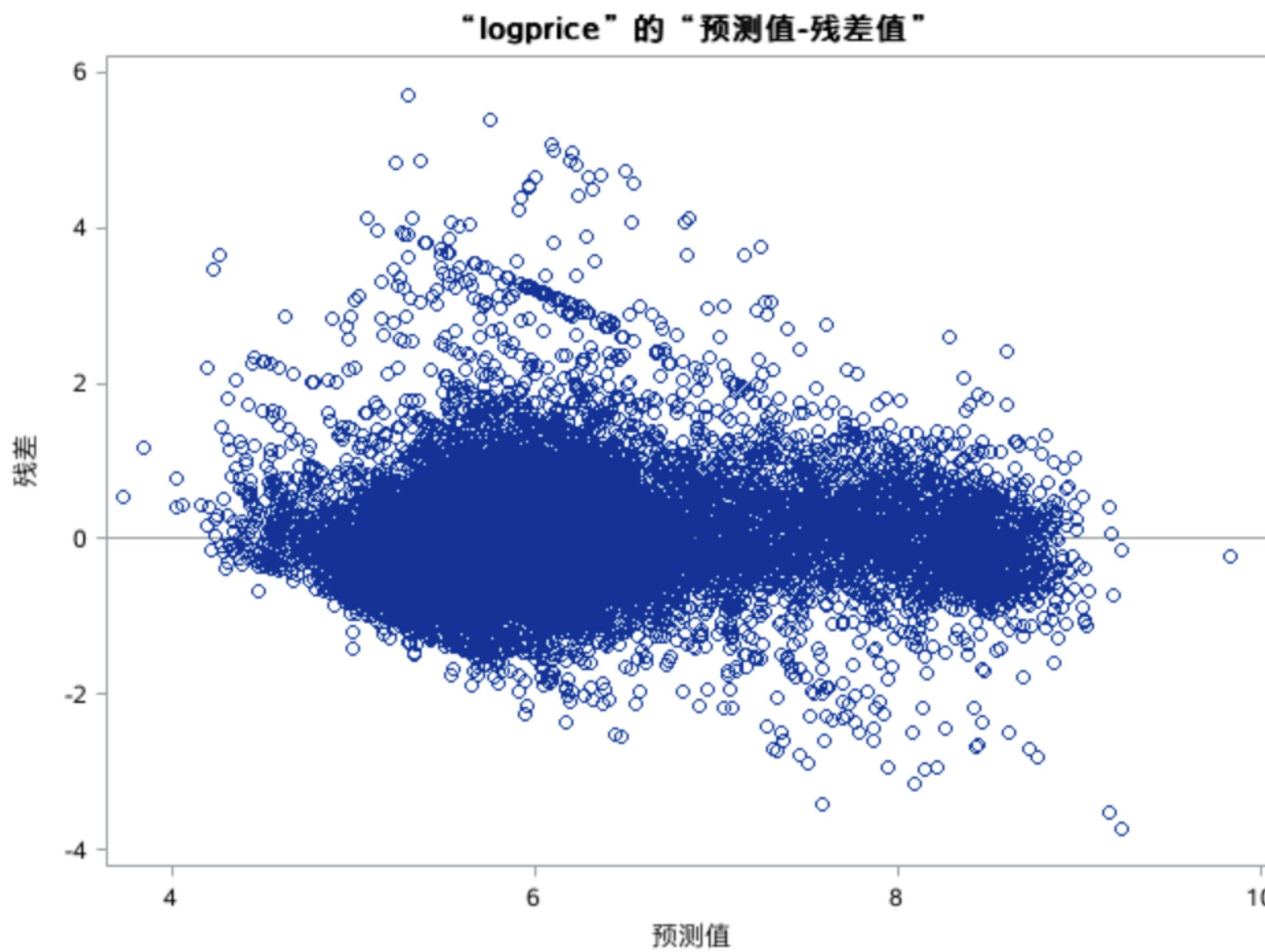
逐步选择汇总										
步	进入的效应	删除的效应	引入效应数	引入参数个数	调整R方	AIC	CP	SBC	F值	Pr > F
0	Intercept		1	1	0.0000	23568.6943	45047.4865	-4054.079	0.00	1.0000
1	accommodates		2	16	0.4760	5730.6547	10467.3123	-21768.719	1673.82	<.0001
2	Basic		3	17	0.5062	4087.5638	8269.0348	-23403.584	1694.01	<.0001
3	bedrooms		4	39	0.5320	2630.6760	6416.7675	-24679.486	70.01	<.0001
4	neighbourhood		5	54	0.5520	1436.7919	4974.9342	-25749.971	83.26	<.0001
5	room_type		6	56	0.5684	406.7124	3785.1774	-26763.597	525.77	<.0001
6	Bathroom		7	57	0.5810	-409.8877	2873.3516	-27571.970	829.13	<.0001
7	bath		8	63	0.5922	-1155.3701	2063.5353	-28268.093	127.70	<.0001
8	property_type		9	76	0.6006	-1712.6512	1471.8930	-28718.428	45.22	<.0001
9	host_total_listings_		10	77	0.6074	-2188.1410	977.8910	-29185.691	480.30	<.0001
10	Checkin		11	78	0.6109	-2434.1109	725.6691	-29423.434	248.38	<.0001
11	has_availability		12	82	0.6133	-2602.2264	554.4941	-29558.643*	44.04	<.0001
12	minimum_nights		13	148	0.6162	-2740.2786	413.9592	-29153.739	4.09	<.0001
13	beds		14	181	0.6181	-2845.4355	308.6028	-28987.417	5.17	<.0001
14	description		15	182	0.6192	-2928.3359	225.9966	-29062.091	84.47	<.0001
15	host_is_superhost		16	183	0.6196	-2951.9548	202.5175	-29077.483	25.46	<.0001
16	Security		17	184	0.6198	-2965.3674	189.2003	-29082.669	15.31	<.0001
17	Kitchen		18	185	0.6198	-2967.3021	187.2914	-29076.377	3.91	0.0480
18	neiover		19	186	0.6198*	-2968.9452*	185.6726*	-29069.794	3.62	0.0571

* 准则的最佳值



Data Analysis

Price Analysis: Model diagnosis



Data Processing

Data Preparation for objective 2

- By observing the remaining missing values, we have the following findings:

1	first_review	10567
2	last_review	10567
3	review_scores_rating	10567
4	review_scores_accuracy	11023
5	review_scores_cleanliness	11023
6	review_scores_checkin	11025
7	review_scores_communication	11023
8	review_scores_location	11026
9	review_scores_value	11026
10	reviews_per_month	10567

	review_scores_rating	review_scores_accuracy	review_scores_cleanliness	review_scores_checkin	review_scores_communication
1	0.0	NaN	NaN	NaN	NaN
2	0.0	NaN	NaN	NaN	NaN
3	0.0	NaN	NaN	NaN	NaN
4	0.0	NaN	NaN	NaN	NaN
5	0.0	NaN	NaN	NaN	NaN
6	1.0	1.0	1.0	1.0	1.0
7	1.0	2.0	3.0	2.0	2.0

- 1. The number of missing values in first_review, last_review and review_scores_rating is the same. The reason for the missing evaluation in this part is that the listings in this part have not been successfully rented out.
- 2. If the customer does not give a complete rating for the stay after completing the rental, the rating of review_scores_rating will become 0, and the ratings of the other six items will be missing.

Data Processing

Data Preparation for objective 2

- After removing the above mentioned observations, we have a missing value profile for the remaining data. The reason for the absence of these observations is that very few customers ignore one or more of the reviews in their reviews.

1	review_scores_rating	0
2	review_scores_accuracy	1
3	review_scores_cleanliness	1
4	review_scores_checkin	3
5	review_scores_communication	1
6	review_scores_location	4
7	review_scores_value	4

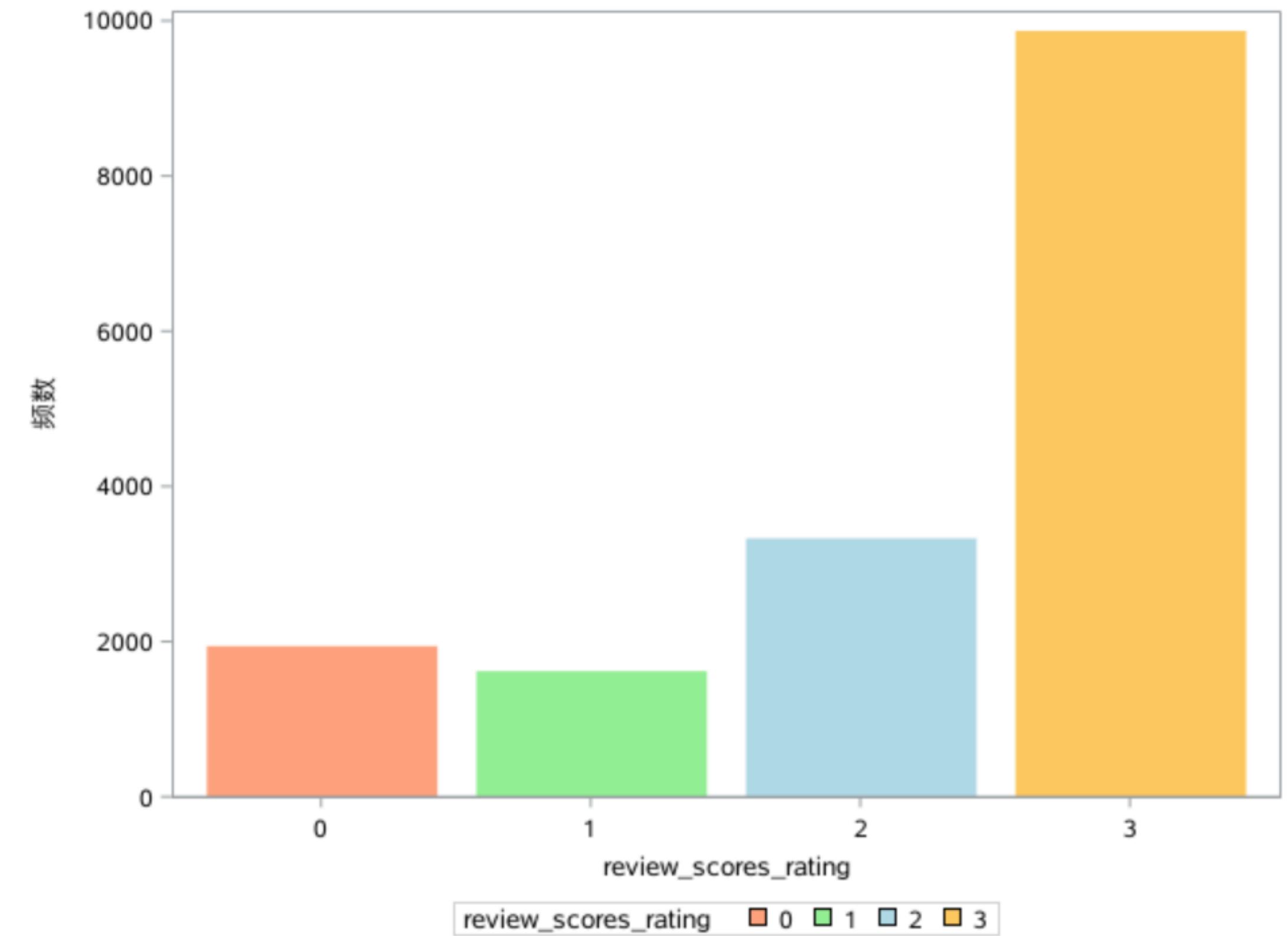
- We found that these few missing features are shared on the same observations, we removed 4 observations with missing review_scores_value and found that there are no any missing values about review, this dataset will be used for research of review.
- We still have **16758** observations left in our data after preprocessing

Data Analysis

Review scores rating Analysis: Classification

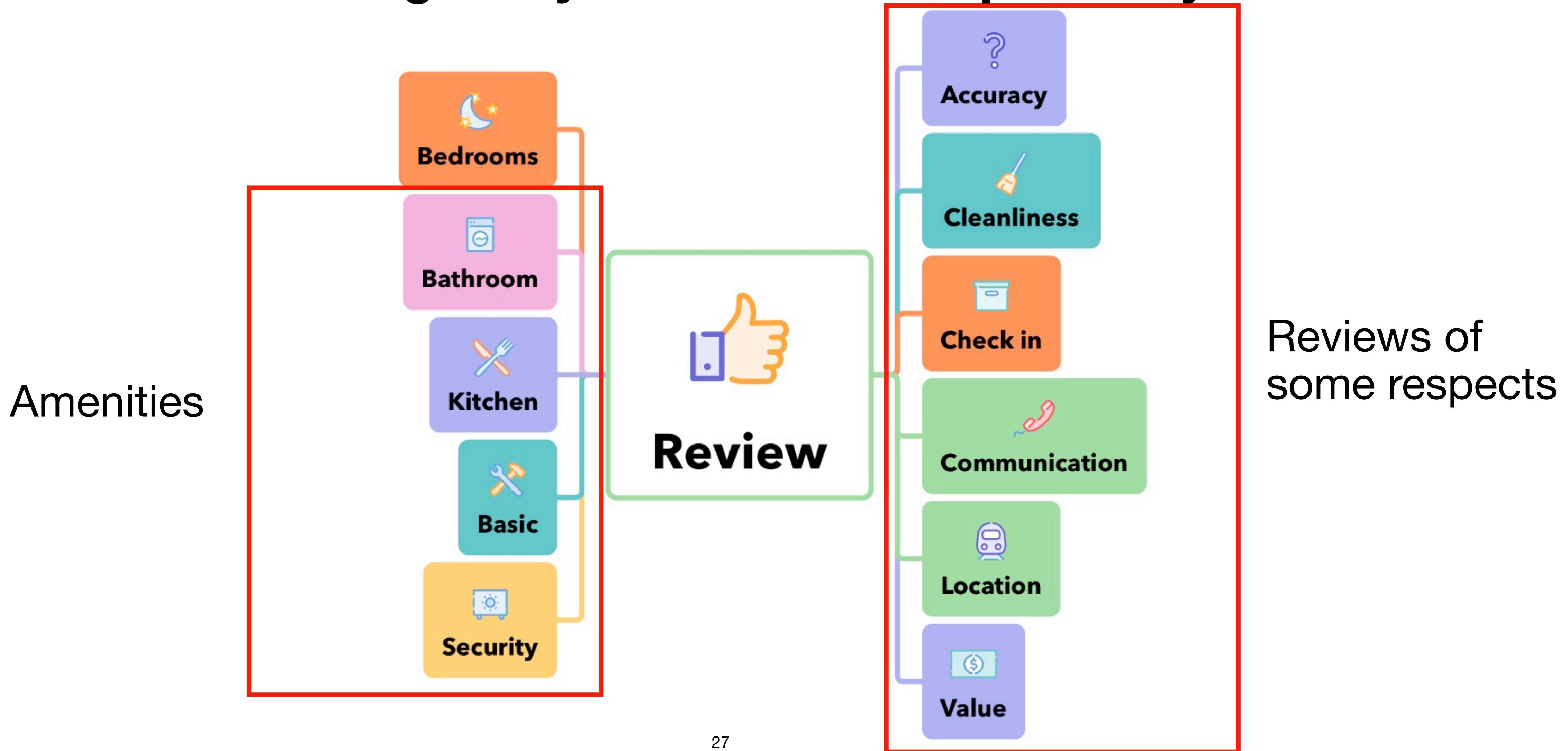


4.9~5.0: 完美体验
4.7~4.9: 超棒房源
4.5~4.7: 优质舒适
0~4.5: 普通房源



Data Analysis

Review scores rating Analysis: Choice of explanatory



Data Processing

Review scores rating Analysis: Accuracy of classification

- We randomly select 25% of the data as the test set and the rest as the training set.

Accuracy in training set

预测概率和观测响应的关联			
一致部分所占百分比	92.9	Somers D	0.860
不一致部分所占百分比	6.9	Gamma	0.862
结值百分比	0.2	Tau-a	0.509
对	47050692	c	0.930

Accuracy in test set

预测概率和观测响应的关联			
一致部分所占百分比	92.5	Somers D	0.852
不一致部分所占百分比	7.3	Gamma	0.854
结值百分比	0.2	Tau-a	0.501
对	5061843	c	0.926

Data Processing

Review scores rating Analysis: result of significance

最大似然估计分析						
参数		自由度	估计	标准误差	Wald 卡方	Pr > 卡方
Intercept	3	1	-88.4743	1.3618	4221.0444	<.0001
Intercept	2	1	-86.1097	1.3416	4119.5868	<.0001
Intercept	1	1	-83.5122	1.3124	4048.9900	<.0001
review_scores_accura		1	3.0496	0.1594	365.9520	<.0001
review_scores_cleanl		1	3.9770	0.1224	1055.7700	<.0001
review_scores_checki		1	3.4649	0.1958	313.0385	<.0001
review_scores_commun		1	3.0691	0.2084	216.9004	<.0001
review_scores_locati		1	0.4795	0.1188	16.2896	<.0001
review_scores_value		1	4.0010	0.1276	983.2207	<.0001
Basic		1	0.4105	0.2234	3.3753	0.0662
Bathroom		1	-0.5437	0.2152	6.3818	0.0115
Kitchen		1	0.7776	0.1943	16.0097	<.0001
Security		1	0.0612	0.0733	0.6976	0.4036
bedrooms		1	0.1069	0.0180	35.4315	<.0001

- This is result of parameter estimation and significance results. We found that most of the variables are significant, only the completeness of security amenities is not significant.
- We think this may be due to the fact that most listings have complete security facilities, which leads to an effect similar to **Simpson's paradox**.

Conclusion

Conclusion

Objective 1

- In general, all the host, the degree of complete amenities of the house, the type of house, the popularity of the house and the capacity of the house have a significant impact on the price.
- As far as **hosts** are concerned, certified and super host homeowners usually set a high price, and host who are more active in introducing their listing will also set a relatively higher price for their properties.
- The prices of all kinds of houses with complete **amenities** will also increase, and the degree of complete basic amenities has the greatest impact on the price of house.

Conclusion

Objective 1

- For the type of housing, in terms of overall price, entire is greater than private and greater than shared, and among building types, upscale buildings such as campsites and villas are more expensive; shabby buildings such as tents and farmhouses are less expensive.
- In terms of **popularity**, high-priced listings are often unavailable within 30 days and available within 60 days; listings in Huangpu and Xuhui districts are overpriced; and listings in Jiading and Fengxian districts are underpriced.
- In terms of **housing capacity**, the larger the capacity and the more the number of bedrooms, the price shows an increasing trend.

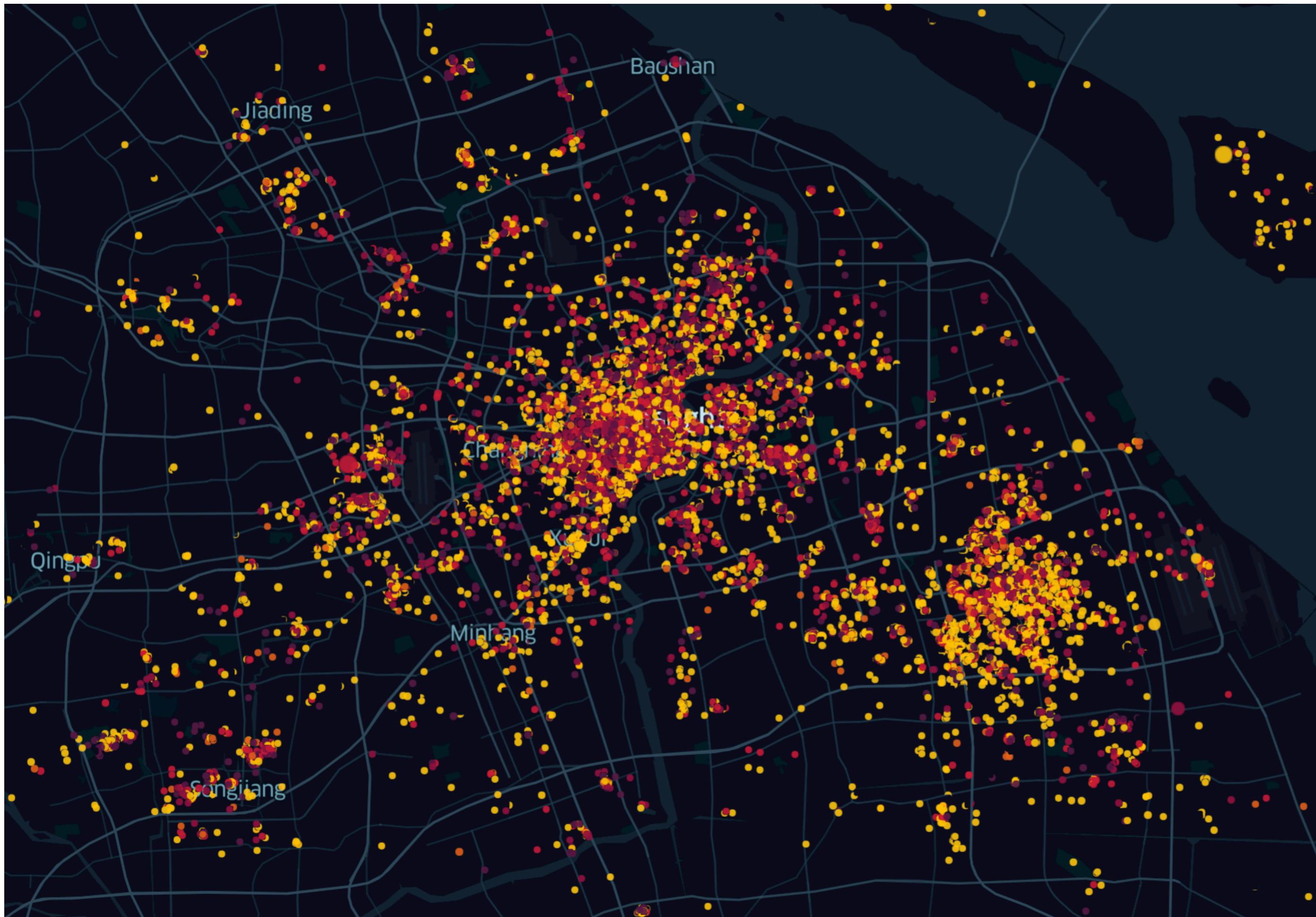
Conclusion

Objective 2

- In general, the scores of various aspects, the degree of completeness of amenities and the number of bedrooms have a significant impact on the overall evaluation of users, and almost all aspects have a **positive impact** on the satisfaction of tenants.
- In terms of **completeness of amenities**, kitchen amenities are the most one which can enhance the satisfaction of the tenants with the occupancy, while tenants are less concerned about security amenities, because most properties have relatively complete security amenities.
- Although **the number of bedrooms** has a significant effect on occupancy satisfaction, an increase in the number of bedrooms has less improvement in occupancy satisfaction.

Conclusion

Filter layers



Thanks for listening