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Airbnb Listings:
A Potential House Price Index[1]

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Abstract

A housing price index (HPI) needs reliable and relevant data. An HPI is important both for household and regulators in choosing housing and in deciding which macroeconomic policy handle may be used. An increasing HPI may be an indication of inflation. When inflation is too low, the central bank may reduce interest rates to attract spending. Meanwhile, when inflation is on uptrend, interest rates may be raised to encourage households to keep money in the bank due to higher returns. One potential source of reliable and relevant data in the creation of an HPI is a collection of listings for rent. This policy brief uses the available listings from the peer-to-peer network Airbnb, collected from the 29th of May to the 1st of June in 2018. Data analysis is primarily focused on elaborating distribution of certain property features of the listings collected. Preliminary analysis has shown a positive relationship between price, ratings, and location.

Background

With the rise of the internet, peer-to-peer markets flourished. These are markets where users participate in availing goods and services with significantly lower transactions costs through the internet. Peer-to-peer markets can be further classified into first-generation and second-generation markets. Unlike the first-generation peer-to-peer markets (which only require remote interactions, such as eBay, Craigslist, and Kickstarter), second generation peer-to-peer markets entail more personal interactions between sellers and users (e.g., face-to-face interactions), requiring trust and credibility within the community and, hence, putting users at more risk. Some examples of second-generation peer-to-peer markets are Airbnb, Uber, etc. For this policy brief, we are interested in trends observed in the online data of the Airbnb room/house listings.

Currently present in 191 countries, Airbnb is an online platform that allows users to both list and rent lodging facilities. The lodgings range from bedrooms to apartments, castles, villas, igloos, and camp sites. Using the online platform, one can view each listing's set of features such as price (per day of rent), photo of the facility, amenities (both included and excluded), and location.

This massive collection of data on property features may be used in creating a house price index. A house price index measures the price change in dwellings in a period specified by the country. It has increasingly become an important monitoring tool for many economists. Macroeconomists and central

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banks need measures of residential property price inflation to identify bubbles, the factors that drive them, instruments that contain them, and to analyze their relation to recessions. Recent literature on housing market has shown the effect of Airbnb in the housing market. Lúðvík Elíasson and Önundur Páll Ragnarsson (2018) show that about 2% annual increase in real house prices can be attributed to the growth in Airbnb apartments over the past three years which accounts for 15% of the rise in real prices of residential housing during the period. The growth in the number of Airbnb apartments based on the measure derived in the paper corresponds to about half to two thirds of new apartments constructed in 2016 in the capital region. A related paper by Stephen Sheppard and Andrew Udell (2016) show that an increase in localized Airbnb availability is associated with an increase in property values.

Why are house price indices important?

A house price index is important both in the household or individual level decision-making process and for macroeconomic managers for a few reasons:

(1) There is a strong correlation between real estate prices, rental prices, and economic growth (e.g., bursting of real estate bubble triggered major bank crises since the 1970s).

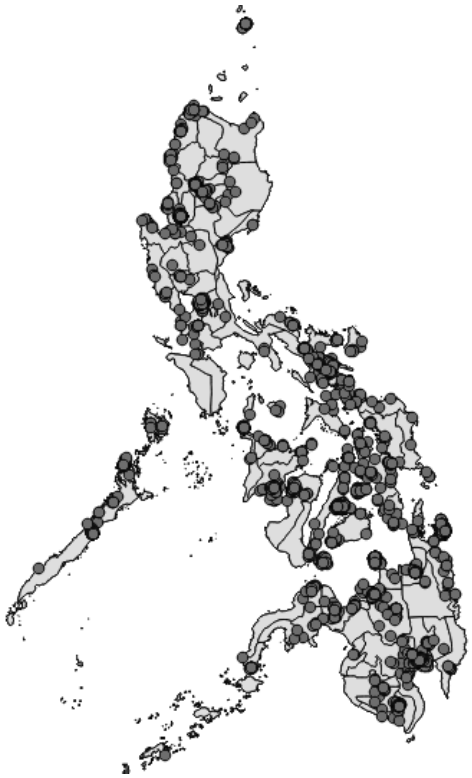
(2) House price indices are closely monitored by macroeconomic managers as they influence financial sectors and household financial stability (e.g., decline in house price leads to increase in homeowner's debt to equity ratio and creditor risk).

(3) For households or individuals, trends in real estate prices are an indicator for buying and selling of property, lifelong family planning, insurance, and property tax. Further considerations include transportation from home to work, access to basic services, among others. Other reasons include benchmarking of interregional properties, comparison of market trends at international level, indexing and valuations of property values, further research on property implicit prices, long-term price trends, among others.

Data and variables

A geographical distribution is shown to illustrate overall presence of the Airbnb properties using the Database of Global Administrative Areas (GADM) boundaries as the main boundary for the Philippine map (*see* Figure 1).

FIGURE 1 Geographical distribution of Airbnb listings across the Philippines



Using Python, Airbnb features and amenities of the property listings were scraped and collected to inspect potential sources of housing price variations. The variables available and used are as follows:

- **House type:** This is the description of the type of room sharing (e.g., entire unit, private room) and the type of housing unit (e.g., villa, apartment, etc.).
- **Price per day of unit:** This is the quoted price per night of the room listing.
- **Latitude and longitude:** This is extracted from the hyperlink embedded on the room listing that can view the room through the Google Maps API (application programming interface).

- **Review count:** This is the count of reviews that have left ratings for the listing.
- **Rating value:** This is the average rating across all reviews left for the listing.
- **Guests:** This is the preferred number of guests recommended by the user for the room listing.
- **Number of bedrooms:** This is the number of bedrooms indicated by the user in the listing.
- **Sleeping condition:** This is the list of specific types of beds indicated by the user in the listing.
- **Cancellation policy:** This is the type of cancellation policy indicated by the user for reservations made in the listing.
- **Restriction on reservation:** This is the note on either the minimum stay of customers, or on what calendar days the room is only available for reservation (e.g., minimum stay, calendar availability).

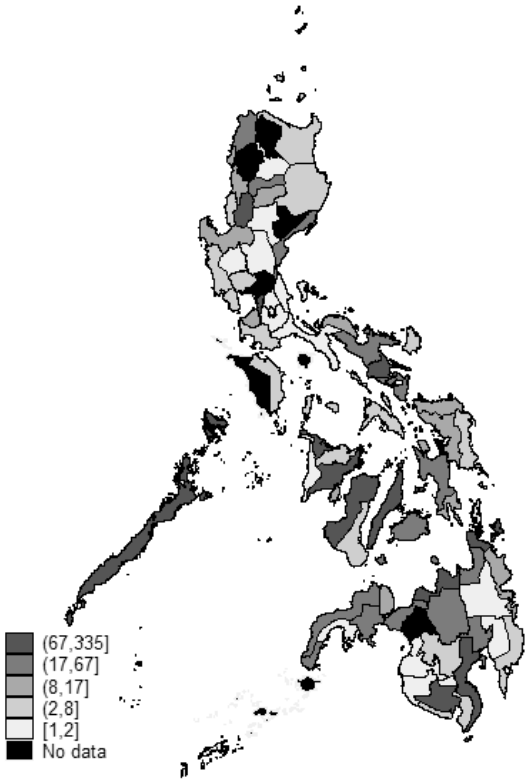
Preliminary statistical analysis

Presence of Airbnb listings in the Philippines

Mapping the listings across the Philippines requires a representation of each location across the Philippine map. To do this, we use point coordinates. Every point coordinate represents a global positional system coordinate, or latitude and longitude coordinate. Both latitude and longitude coordinates run from -180° to 180° representing south to north locations for latitude, and west to east locations for longitude, respectively. Figure 1 shows the point coordinate distribution of each listing across the Philippines. A provincial distribution of count of each point coordinate is shown in Figure 2.

A number of provinces have no recorded listing in the dataset. These are Abra, Apayao, Basilan, Bulacan, Lanao del Sur, Marinduque, Occidental Mindoro, Quirino, and Sulu. Meanwhile, the provinces with the highest listing frequency (i.e., counts above 100) were Cebu, Metro Manila, Davao del Sur, Benguet, Surigao del Norte, and Misamis Oriental (*see* Table 1, Appendix).

FIGURE 2 Count of listings per province



Metro Manila is a province unit in this figure.

Most booked housing types, number of guests

Ranked by count, Table 2 (in Appendix) shows that the top five house types are: entire apartment (450 counts), entire condominium (420), private room in house (321), entire house (290), and private room in breakfast and bed (206).

Table 3 (in Appendix) shows the count distribution per declared number of guests. It suggests that listings most oftenly accommodate two (2) to four (4) guests, representing 65.32% of total listings. Table 2 (in Appendix) shows the count distribution per declared number of bedrooms, showing that most booked are studio-type (no bedroom separations) or one- (1) to two- (2) bedrooms only. This seems to sync with the number of guests that most of the listings accommodate.

Among cancellation policies, Table 5 (in Appendix) shows the least chosen cancellation policy is 'moderate' with 789 counts, while the top cancellation policy is 'flexible' at 1155. Flexible cancellation policy allows bookings to be cancelled closer or on the day itself of booking with no charges. Meanwhile, moderate cancellation policy

is stricter, depending on the rules set by the listing owner. Flexibility of cancellation plays a role in booking decisions of end users, where stricter cancellation policies are perceived as transaction costs. Naturally, end users prefer the least possible cost.

Top property features or amenities

Property features or amenities that appear as the most available are 'essentials'—with 2700 counts across listing observations, hangers (2244), air conditioning (2212), kitchen (2186), and Wi-Fi (2120).[4]

Meanwhile, the amenities that appear the least common are carbon monoxide detector (2596), heating (2461), private entrance (2114), hair dryer (2104), and washer (2072). A unit with more features are found more useful by the users.

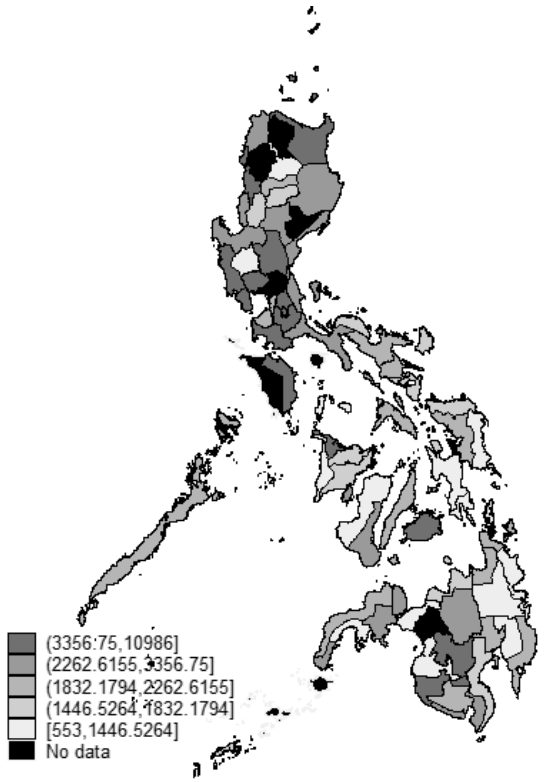
Price and rating value

The provinces with the highest average daily price (in Php) are the following: Laguna, Batangas, Oriental Mindoro, Zambales, North Cotabato, Rizal, Pampanga, and Bohol. These are also the provinces with the least number of Airbnb listings available (*see* Figure 1 and Table 1, Appendix).

Are there certain aspects of listings that drive its daily price up or down? Rating value is a factor which may affect the daily change in price. This brief looks into the possible co-movement of average price and rating per province. This distribution is shown in Figure 3.

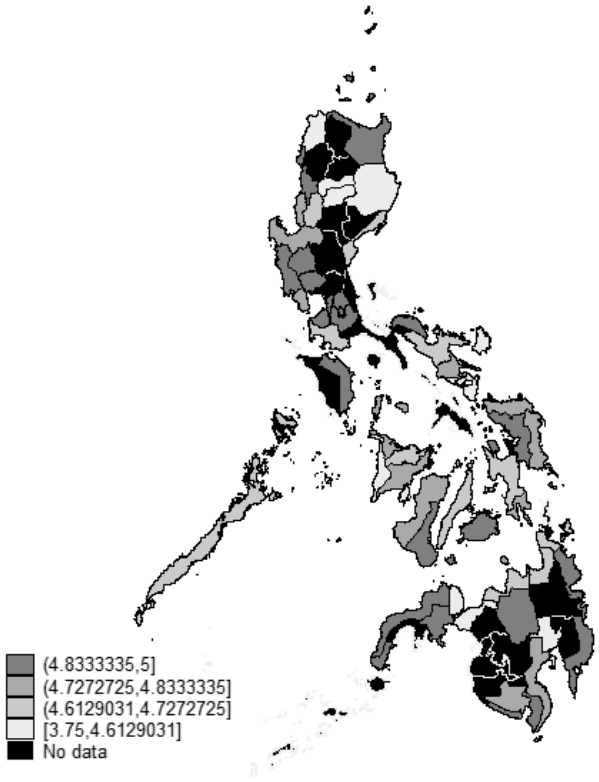
Figure 4 shows that there are additional provinces with missing data on rating value. This is because some listings have missing rating values due to having zero (0) reviews. The same figure also shows that all listings are rated at least 3.75 stars on average, which leaves less room of variation across all possible rating values. In relation to the geographical distribution of average price, there does not seem to be a conclusive relationship between price and rating value. For a more comprehensive look at the two aspects' relationship, consider Figure 5.

FIGURE 3 Average price per night, per province



Metro Manila is a province unit in this figure.

FIGURE 4 Average rating value per province

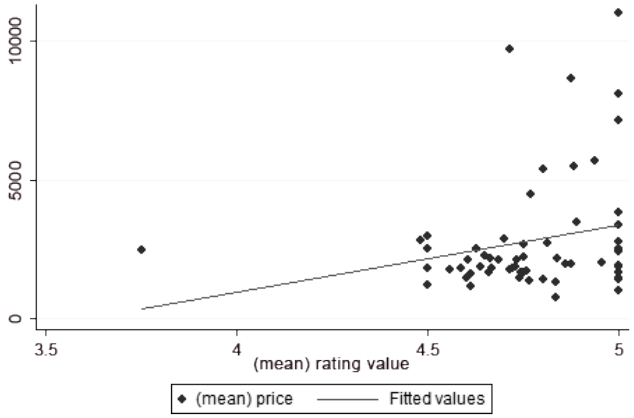


Metro Manila is a province unit in this figure.

[4] Television (TV) and cable TV are classified separately. If grouped together, they would be one of the top amenities available.

Figure 5 shows a scatter plot of average price by average rating per province. While Figure 5 shows a positive correlation in the fitted line of values, there seems to be no strong evidence of a positive correlation between average price and average rating value in the figure.

FIGURE 5 Correlation between average price and average rating per province



Moving forward

This policy brief has demonstrated Airbnb as a fertile source of data which may be used to analyze further house rent and/or price dynamics with respect to property features including location, type of housing, wifi access, among others. Simple correlation indicates that the higher the review or rating of customer satisfaction, the higher the price. This may confirm that the market is at work that quality of the listing measured by reviews has a positive.

Airbnb listings are found the most at economically significant provinces such as Cebu, Metro Manila, and Davao. Concentration of businesses and labor-intensive industries in these areas may be the reason why more listings are found in these locations. In addition to this, these provinces are also the ones with the market infrastructures which allow peer-to-peer market such as Airbnb to flourish—internet connectivity, security, among others. Validating cause and effect in this case needs further investigation, but government might want to consider emerging available housing base as a criterion for prioritizing industrialization and attracting investment.

Interestingly, however, the highest priced listings (on average) are found in provinces where listings are least likely to be found. This may be a problem of some homeowners not willing to enroll and list their unit for rent due to lack of internet access or lack of knowledge in leasing out their available space. Perhaps a knowledge drive on available technologies for households in informing them of these business opportunities might help them access non-labor income.

Review of the unit, features of the house such as number of rooms, amenities provided such as essentials, air conditioning unit, among others are important in price determination and frequency of booking. The listings with the most favorable features and highest review can command price and importance in the market. For example, the amenities most frequently available—essentials and air conditioner—are basics for any traveler (e.g., shampoo and soap), and necessary for the warm temperature of the country. It would be interesting to compare this data with other countries.

The most booked housing types, which are apartment and condominium, may provide the insight that owners more commonly rent out smaller housing units, comparable with hotels, which are the conventional rental accommodation—unlike in other countries, where owners rent out a room within the owner's house, for example. There will be more interesting insights to draw from this angle if data is compared against other countries. In addition to this, the most common number of renters for a listing is two to four persons, which usually fits into an average apartment or condominium. Government thus may need to adapt building housing units accommodating these housing types and number of residents if the high frequency is an indication of housing demand.

Other features such as flexibility seem to follow the market trend as the most frequent cancellation policy listed is 'flexible,' allowing renters to book and cancel nearest to or on the booked date. It would be interesting to see if there would be a possible way to trace owners who switch their flexibility in booking, and their motivations for doing so.

The authors will further investigate other factors which may have contributed to the price trend especially for those provinces observed in Table 1 (in Appendix). Authors would also like to further explore the effect of urbanity of areas which based on preliminary analysis does not correlate with a higher rental price. The dataset may also be used in

tracking dynamic changes for business and tourism activities in the Philippines by comparing the listings with the hotel data, and other property index. This added component may shed light into other policy issues (in addition to the ones primarily addressed by the housing price index discussed in the first section) such as determining appropriate taxes for real property and idle land, as well as zoning issues for urban planning.

Further on, the dataset may be utilized in the construction of a house price index. The creation of an official house price index has its own issues. Ideally, the dataset should be expanded into a dataset with an added time dimension (i.e., observing the same listing for multiple months or weeks) to control for time-dependent variations such as seasonality (e.g., dry seasons, long weekends), and should identify a replacement measure for floor area.

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Appendix: Statistical Tables

TABLE 1 Count and average price of listings per province

Province	Frequency	Average price
Cebu	335	2,100.80
Metropolitan Manila	298	2,181.65
Davao del Sur	278	1,657.08
Benguet	237	1,750.04
Surigao del Norte	233	2,161.98
Misamis Oriental	159	1,689.24
Iloilo	96	1,469.33
Negros Occidental	93	1,361.72
Palawan	91	2,262.62
Albay	86	2,129.47
Aklan	85	4,459.89
South Cotabato	77	1,889.53
Batanes	69	2,531.01
Camarines Sur	67	1,860.16
Leyte	67	1,162.36
Mountain Province	62	2,132.07
Camiguin	48	1,735.35
Ilocos Norte	42	2,810.14
Davao del Norte	40	1,841.75
Agusan del Norte	39	1,832.18
Zamboanga del Norte	25	1,948.32
Bohol	23	5,506.09
Zamboanga del Sur	23	2,751.83
Bukidnon	22	2,505.86
Siquijor	22	1,958.00
Sorsogon	22	1,789.77
Aurora	20	2,849.95
Lanao del Norte	19	1,446.53
Ifugao	17	1,621.00
Surigao del Sur	15	1,438.07
Northern Samar	12	1,662.92
Cavite	11	2,002.18
Guimaras	11	2,513.18
Misamis Occidental	11	2,467.09
Pangasinan	11	2,740.55
Biliran	10	1,669.30
Camarines Norte	10	1,471.60
Samar	10	1,900.90
Southern Leyte	10	1,305.80
Ilocos Sur	9	3,472.44
Cagayan	8	3,844.00
Eastern Samar	8	1,434.75
La Union	8	2,676.75
Negros Oriental	8	3,356.75
Pampanga	8	5,696.75
Batangas	7	9,709.57
Davao Oriental	7	1,873.14
Catanduanes	6	1,822.17
Masbate	6	1,857.83
Bataan	5	5,372.20
Capiz	5	1,811.40
North Cotabato	5	7,756.60
Isabela	4	2,972.25
Oriental Mindoro	4	8,633.75
Romblon	4	762.25
Zambales	4	8,108.00
Sarangani	3	2,421.67
Agusan del Sur	2	1,184.00
Antique	2	1,237.50
Compostela Valley	2	869.00
Kalinga	2	1,445.50
Maguindanao	2	1,368.00
Nueva Vizcaya	2	2,628.00
Quezon	2	2,628.00
Sultan Kudarat	2	5,183.50
Zamboanga Sibugay	2	553.00
Dinagat Islands	1	1,211.00
Laguna	1	10,986.00
Nueva Ecija	1	3,522.00
Rizal	1	7,149.00
Tarlac	1	999.00
Tawi-Tawi	1	1,525.00

TABLE 2 Count and distribution of house prices across declared house types

House types	Mean	Freq	SD
Entire apartment	2,075.48	450	1,831.02
Entire condominium	1,767.25	421	1,011.10
Private room in house	1,371.14	321	991.32
Entire house	3,168.87	290	3,537.05
Private room in bed and breakfast	1,788.52	206	1,449.22
Private room in apartment	1,126.42	117	843.62
Entire serviced apartment	2,193.83	75	1,310.19
Entire bungalow	2,711.78	72	2,619.26
Private room in hostel	1,172.21	67	891.89
Private room in guesthouse	1,512.84	63	1,068.21
Entire villa	8,729.73	63	9,600.55
Private room in condominium	1,432.48	60	754.25
Private room in bungalow	2,241.09	55	2,063.41
Private room in guest suite	1,525.08	48	1,207.79
Entire townhouse	2,172.85	48	1,553.84
Room in boutique hotel	2,262.87	45	1,215.74
Entire loft	2,413.60	42	1,484.41
Private room	1,336.50	38	882.38
Entire guesthouse	1,898.74	38	1,746.40
Private room in nature lodge	1,602.53	30	932.01
Room in hotel	1,628.10	29	972.99
Private room in hut	1,469.19	26	742.31
Private room in cabin	2,146.84	25	2,765.92
Room in aparthotel	1,462.04	24	622.26
Private room in villa	3,120.13	23	2,251.34
Entire guest suite	2,941.05	22	3,847.71
Shared room in hostel	817.86	22	933.18
Hut	1,526.15	20	1,362.92
Entire cabin	3,901.68	19	2,983.37
Entire place	1,704.00	16	912.96
Entire cottage	4,018.87	15	3,140.48
Private room in resort	2,912.07	14	1,798.72
Private room in loft	1,453.82	11	774.80
Shared room in house	721.30	10	290.29
Private room in townhouse	1,178.40	10	696.77
Farm stay	4,458.11	9	4,308.74
Private room in serviced apartment	1,690.67	9	737.48
Shared room in bed and breakfast	986.88	8	751.32
Entire chalet	3,427.86	7	712.91
Entire bed and breakfast	3,510.50	6	5,507.11
Private room in cottage	1,911.67	6	323.31
Shared room in condominium	369.00	5	0.00
Entire hostel	2,126.00	5	1,521.44
Shared room in apartment	872.80	5	568.30
Island	7,741.75	4	8,363.20
Private room in tiny house	697.25	4	176.15
Private room in farm stay	1,052.25	4	283.33
Campsite	1,052.33	3	366.92
Shared room in casa particular (cuba)	6,261.00	3	2,349.37
Shared room in guesthouse	1,350.67	3	1,165.55
Treehouse	2,435.67	3	2,200.85
Earth house	2,401.00	3	688.56
Tiny house	719.33	3	203.12
Shared room in hut	894.67	3	268.55
Private room in chalet	1,070.00	3	447.34
Private room in treehouse	1,594.33	3	497.06
Private room in houseboat	6,176.50	2	919.50
Nature lodge	1,867.00	2	343.00
Private room in tipi	1,130.50	2	393.50
Private room in tent	1,789.50	2	209.50
Shared room in nature lodge	763.00	2	26.00
Private room in casa particular (cuba)	4,844.50	2	52.50
Shared room in island	999.00	1	0.00
Shared room in tent	736.00	1	0.00

TABLE 2 Count and distribution of house prices across declared house types *(continued)*

House types	Mean	Freq	SD
Shared room in resort	948.00	1	0.00
Entire resort	2,475.00	1	0.00
Private room in pension (South Korea)	527.00	1	0.00
Private room in earth house	1,997.00	1	0.00
Shared room in cabin	24,995.00	1	0.00
Private room in castle	3,949.00	1	0.00
Shared room in serviced apartment	1,000.00	1	0.00
Shared room in hotel	684.00	1	0.00
Shared room in treehouse	526.00	1	0.00
Barn	1,682.00	1	0.00
Shared room in bungalow	526.00	1	0.00
Shared room	526.00	1	0.00
Private room in island	790.00	1	0.00
Total	**2,121.53**	**2,961**	**2,624.10**

TABLE 3 Count and distribution of house price across declared number of guests

No. of guests	Mean	Freq	SD
1 guest	686.83	60	220.67
2 guests	1,423.08	921	847.53
3 guests	1,625.85	359	915.31
4 guests	1,973.35	654	1,728.90
5 guests	2,059.50	210	1,440.02
6 guests	2,755.97	250	2,189.97
7 guests	2,918.31	49	3,214.23
8 guests	3,103.25	121	3,551.06
9 guests	6,678.56	16	9,827.85
10 guests	4,041.85	99	6,442.73
11 guests	4,627.38	8	7,278.70
12 guests	4,388.00	56	4,749.83
13 guests	6,164.50	6	6,228.77
14 guests	4,937.00	18	4,641.63
15 guests	4,426.58	26	4,207.59
16+ guests	3,565.36	108	5,418.80
Total	**2,121.53**	**2,961**	**2,624.54**

TABLE 4 Count and distribution of house price across declared number of bedrooms

Room type	Mean	Freq	SD
Studio	1,596.23	610	1,248.80
1 bedroom	1,677.63	1509	1,325.04
2 bedrooms	2,703.62	457	2,145.07
3 bedrooms	3,587.21	202	3,455.93
4 bedrooms	5,144.77	74	7,451.48
5 bedrooms	5,364.17	42	9,446.00
6 bedrooms	4,592.47	19	5,389.48
7 bedrooms	1,646.29	7	1,615.50
8 bedrooms	4,371.00	7	6,288.40
9 bedrooms	13,755.33	3	22,730.34
10 bedrooms	1,334.36	14	784.49
12 bedrooms	1,517.67	6	1,242.96
13 bedrooms	763.00	2	186.68
14 bedrooms	999.00	1	
16 bedrooms	526.00	1	
17 bedrooms	999.00	1	
18 bedrooms	1,053.33	3	241.35
20 bedrooms	1,594.33	3	697.44
Total	**2,121.53**	**2,961**	**2,624.54**

TABLE 5 Count and distribution of house price across declared cancellation policies

Policy	Mean	Freq	SD
Flexible	1,721.77	1,157	1,640.95
Moderate	2,104.41	790	1,907.73
Strict	2,590.99	1,014	3,717.07
Total	**2,121.53**	**2,961**	**2,624.54**

TABLE 6 Summary statistics of house prices across municipalities and cities (as of end of 2014)

	Mean	Freq	SD
Across municipalities	2,614.65	1,062	3,559.09
Across cities	1,841.32	1,877	1,858.40
Total	**2,120.76**	**2,939**	**2,630.17**

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