

TIME SERIES ANALYSIS OF AIRBNB HOUSE RENTALS PRICE IN THE BALKAN REGION

Milica Maricic

University of Belgrade, Faculty of Organizational Sciences, Department of Operational Research and Statistics
Jove Ilica 154, 11000 Belgrade, Serbia
E-mail: milica.maricic@fon.bg.ac.rs

Katarina Cvetic

University of Belgrade, Faculty of Organizational Sciences
Jove Ilica 154, 11000 Belgrade, Serbia
E-mail: kcvetic0@gmail.com

Marina Ignjatovic

University of Belgrade, Faculty of Organizational Sciences, Department of Operational Research and Statistics
Jove Ilica 154, 11000 Belgrade, Serbia
E-mail: marina.ignjatovic@fon.bg.ac.rs

Veljko Jeremic

University of Belgrade, Faculty of Organizational Sciences, Department of Operational Research and Statistics
Jove Ilica 154, 11000 Belgrade, Serbia
E-mail: veljko.jeremic@fon.bg.ac.rs

Abstract: Shared accommodation is one of the most recognizable business models of sharing economy. Shared accommodation enables residents to temporarily rent out their properties to others through online platforms for a predetermined price and for a defined period of time. One of the factors which impact the success of the business model is the daily rental price. The research question we raise in this study is related to daily housing rentals price prediction of Airbnb properties. In our case study, we used ARIMA modelling to model and predict housing rentals prices of the properties listed on the Airbnb platform in Ljubljana, Slovenia and Zagreb, Croatia.

Keywords: Sharing economy, Shared accommodation, Airbnb, Time series analysis, Balkan region.

1 INTRODUCTION

First mentioned in 2008, sharing economy is defined as „collaborative consumption made by the activities of sharing, exchanging, and rental of resources without owning the goods” [1]. Over time, the sharing economy has attracted the interest of various scientific disciplines, such as economics, law and business administration. For example, the subjects of macroeconomic research are the reasons and motivation of people to participate in the new way of consuming products and services [2]. The popularity of the sharing economy phenomenon is constantly increasing among consumers and various other stakeholders. The rise of the Internet and Web 3.0 significantly contributed to the digital transformation that has enabled new forms of consumption. As a result, the relationship between the consumer and the product has changed, and the traditional way of consumption, which implies ownership of the product, has been overcome [3]. Looking at the four distinct categories of the sharing economy in tourism – tour guide services, transportation, dining, and accommodation [4], and with the last being the most prominent sector in the economy of tourism in general [5], it is important to discuss the economic and social implications of the quick rise of a new sharing model – peer to peer accommodation or shared accommodation. Shared accommodation is predominantly realised on platforms such as Airbnb, Couchsurfing, HomeAway, Home Exchange and others.

The research question we raise in this study is related to daily housing rentals price prediction of Airbnb properties. As the data on housing rentals prices are available over time, time series (TS) time series analysis deemed suitable for implementation. In our case study, we

used ARIMA modelling [6] to model and predict housing rentals prices of the properties listed on the Airbnb platform in Ljubljana, Slovenia and Zagreb, Croatia. In section two, we outline a brief literature review on the issue of pricing and price predictions of Airbnb listing. In the following section, we present our case study and study results. Finally, we finish the paper with a discussion and concluding remarks.

2 LITERATURE REVIEW

Airbnb operates as a multi-sided platform, where hosts and guests communicate and trade directly, and the platform earns a commission from both sides of the market. For hosts, the value Airbnb offers lies in lowering potential risks by identifying adequate guests, as well as helping in the operational and promotional aspects of renting spaces, while simultaneously offering value to the potential guests – Airbnb filters acceptable accommodation, lowering the risk in that regard, as well as delivering an enhanced travel experience [7]. The numbers associated with Airbnb's business are impressive. Currently, there are over 6 million active listings, over 4 million hosts and a base of over 150 million users on the platform. Airbnb is growing its business worldwide, and currently operates in 191 countries [8], including Croatia, and Slovenia, on which this work is based on. One of the crucial things for Airbnb hosts is setting the right prices for their listings, in order to achieve their own financial goals. This is something that the company itself recognises, which is why they constantly put an effort to provide a suitable help in the forms of specific pricing tools and tips. To do so, it is important to identify the price determinants and power of their influence. To explore the price determinants of accommodations in the sharing economy, in their research Wang and Nicolau [9] used ordinary least squares (OLS) and quantile regression (QR). The results show that attributes such as superhost status, more listings, and verification, all influence the price increase. Setting the right price is not an easy task, so there have been a lot of researchers trying to find a solution through modelling and predicting price. In one of the recent studies, a group of authors [10] used time series analysis for such a purpose as well.

3 TIME SERIES ANALYSIS OF THE RENTAL PRICES ON THE AIRBNB PLATFORM

A time series analysis was conducted to analyse and predict the rental prices on the Airbnb platform in the Balkan region. Two cities were chosen for the analysis: Ljubljana, Slovenia and Zagreb, Croatia. The data was retrieved from the website Alltherooms.com [11] for the period from 19th December 2022 until 1st May 2023. The available data were weekly average daily price rentals. The prediction period was from 8th May to 5th June 2023. To model the time series (TS) ARIMA (p,d,q) models and Box Jenkins methodology to ARIMA models were used, while the best model selection criterion was the Akaike Information Criterion (AIC) [6]. To explore the stationarity of the TS Augmented Dickey Fuller test was used (ADF). The presence of autocorrelation was assessed using the Durbin Watson test (DW), while the presence of heteroskedasticity was assessed using ARCH test.

3.1 Time series of the rental prices on the Airbnb platform in Ljubljana

The collected data is presented in orange in Figure 2. From it, we can see that there was a sharp rise in the rental price around New Year's Eve to 167 euros. After that period, the prices dropped sharply to 80 euros and slowly increased to 119 euros per night until the end of the observed period. First, it was necessary to determine whether the Ljubljana TS needed integration. ADF test was performed. In the level, the value of the ADF statistics is -2.286 with

$p > 0.05$. Therefore, the conclusion is that the TS should be integrated. In the 1st difference, the value of the ADF statistics is -7.323 with $p < 0.05$. The result in the 1st difference indicates that there is no need to further integrate the TS. In the next steps, several ARIMA models have been created. The model with the lowest AIC was ARIMA (1,1,0) with AIC of 8.425. The obtained R squared was 0.1071. The value of the Durbin Watson statistics is 1.339 which is in the region where the presence of autocorrelation cannot be determined. The value of the ARCH test statistics is 0.707, with $p > 0.05$. Therefore, we accept the null hypothesis and conclude that homoskedasticity is present in the model. Considering all the performed tests, the model can be used for predictions. The Ljubljana TS forecasting is presented in Figure 1.

In the future period, in May and June 2023, according to our model, the predicted values of average daily rent on the weekly level in Ljubljana will be from 118.628 Euros to 120.581 Euros. We can see a slight increase in the rental prices, but the increase is minimal. Therefore, no major price change can be expected.

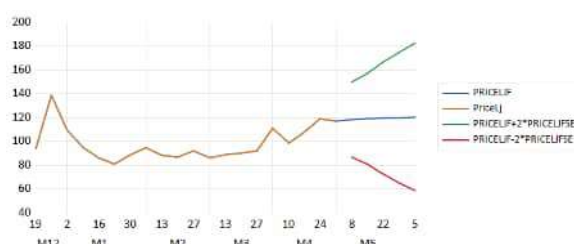


Figure 1: TS modelling results for Airbnb price rentals in Ljubljana, Slovenia: collected and predicted data

3.2 Time series of the rental prices on the Airbnb platform in Zagreb

The collected data is presented in orange in Figure 2. From it, we can see a sharp rise in the renting price around New Year's Eve to 167 euros. After that period, the prices dropped sharply and oscillated around 80 euros per night until the end of the observed period. First, it was necessary to determine whether the Zagreb TS needed integration. ADF test was performed. In the level, the value of the ADF statistics is -8.678 with $p < 0.05$. Therefore, the TS should not be integrated, and there is no trend in the data. In the next steps, several ARMA models have been created. The model with the lowest AIC and model elements which were statistically significant was ARIMA (1,0,0) with AIC of 9.425. The obtained R squared was 0.357. The value of the DW statistics is 1.726 which is in the region where the presence of autocorrelation cannot be determined. The value of the ARCH test statistics is 0.090, with $p > 0.05$. Therefore, we conclude that homoskedasticity is present in the model. Taking into account all the performed tests, the model can be used for predictions. The Zagreb TS forecasting is presented in Figure 2

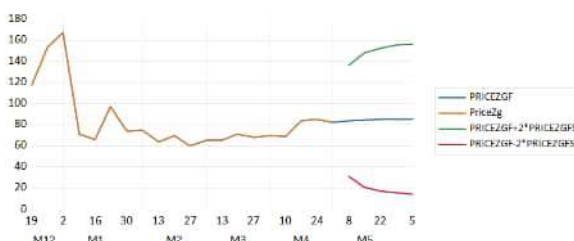


Figure 2: TS modelling results for Airbnb price rentals in Zagreb, Croatia: collected and predicted data

In the future period, in May and June 2023, according to our model, the predicted values of average daily rent on a weekly level in Zagreb will be from 83.537 Euros to 85.486 Euros. We can see a slight increase in the rental prices, but the increase is minimal. Therefore, no major price change can be expected. However, seasonality should be considered, as the main touristic season in Croatia is in the summer period.

4 DISCUSSION AND CONCLUSION

The results of our study show that TS analysis can be used with success to model the prices of Airbnb listings in the Balkan region. In Zagreb, Croatia, the data shows a stable pricing market with low volatility. On the other hand, in Ljubljana, Slovenia, the data demonstrate a positive trend, signalling that the price rentals are expected to grow at a stable pace in the upcoming period. The limitation of the conducted research is the relatively short time series which was available. The study could be extended to other cities and countries in emerging markets in the Balkan region [12]. We hope that this study might act as an impetus for further research on the topic of sharing economy in the Balkan region.

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