Long-Term Rental Incentive Program Machine Learning Project Proposal

Background

While many travelers and homeowners are excited by the money-saving and wealth-creating capacity of short-term leasing/rentals, which has become increasingly popular due to online platforms such as AirBnB, there are several negative public externalities that local governments and its residents are concerned about. These externalities include reducing the housing stock available for long-term renters (including “affordable” housing - that which costs 30% or less of household income)[[1]](#footnote-0), concerns about public health and safety based on the conditions of unregulated short-term leases, impacts on the vitality of neighborhoods, noise, and civil rights violations (i.e. lessor discrimination) among others.

When the community offering and booking short-term rentals was small, in spite of this transaction being illegal in many places, most cities did not recognize this as an immediate problem. As short-term leasing platforms have become more popular, cities have faced increasing pressure from important players in the hospitality industry to regulate short-term rentals as it was cutting into their business, and undercutting laws imposed on them to protect public health and safety. Additionally, fair-housing advocates, neighborhood members, and (in turn) local officials began to see short-term rentals as direct threats to the stability of communities and the availability of affordable housing in desireable (hot) areas. Just as Uber and Lyft had, AirBnB started to receive the ire of many, deserved or not.

To sweeten the pot, cities are constantly interested in exploring ways in which they can increase revenue to improve the delivery of city services and improve infrastructure. At this point, most cities have acknowledged that short-term leasing needs to be addressed legally on a municipal level (some State governments are even weighing in with legislation). And while the positive or negative impacts of allowing short-term leasing are still being determined[[2]](#footnote-1), cities are beginning to consider how to design and implement legislation that seems extremely difficult to enforce, technically, logistically, and financially.

Predictive analytics policy recommendation

The Long-term Rental Incentivization Program (L-TRIP) team seeks to assist city code enforcement and housing rights advocates by utilizing predictive analytics to identify neighborhoods or homeowners who could be targeted for a training designed to explain the benefits of offering long-term housing as opposed to short-term housing, even if greater revenue from short-term leasing would seemingly encourage them to do otherwise.

Even more, the team plans to suggest a carrot and stick approach to enforcement. Research has shown that it is not too difficult to identify those who are renting out homes illegally (how illegal is determined depends on the locale). While the training would be the carrot, targeting homeowners (and times even lessee’s) who are violating the law for fines would be the stick. We may discuss the idea that violators engage in the training and such engagement can lead the city to reduce the amount of the fine.

Analytical modeling and data sources

Our theory is that the if the rental revenue difference is above or below a certain percentage[[3]](#footnote-2) of the Airbnb revenue, policy-makers should have different responses. For example, people who can earn slightly more through Airbnb may be persuaded with targeted trainings, while people who can earn a lot more may need to be regulated. This value can vary from city to city. Hence we will find the average threshold across cities. We will also test how generalizable our model is based on its accuracy with new data from other areas of the world. Therefore, our analysis will also include an evaluation of the impact of different caps on length of stay based on city law.[[4]](#footnote-3) Research has shown that a cap on the number of days a short-term rental can be leased has an impact on the per-night earnings of a lessor.

The L-TRIP team plans to utilize now publicly available listing data on US cities scraped from AirBnB, RCC America and Zillow to predict occupancy rates and differentials between Airbnb and rental revenue to assist cities with this response. Various machine learning models will be used to predict Airbnb and rental occupancy rates for listings. Rental and Airbnb rates will also be derived from the data to calculate the difference in possible earnings.

This information will be used to tailor an intervention for homeowners in order to increase their likelihood of renting out their property long-term. In essence, we plan to understand how and when the best time and method to approach a homeowner is.

In the midst of our analysis and further research on the topic, we will also try and develop some heuristics (expert and simple via a decision tree model) to inform a baseline to measure the precision and recall of our length of stay predictions as we create our models.

Expected Impact

The anticipated impact of the project will be to ease enforcement of city (and sometimes State) policies meant to protect vulnerable renters, as well as public health and safety. This evidence-based approach will enable municipalities in their use of scarce resources to deal with this enormously complex issue.

The policy recommendation that will come of our work will be two-fold. The first is to develop a model for how and when cities can target existing and new homeowners with a certain predicted income differential (delta) with an intervention. Another goal is to understand the impact of specific length of stay caps and make a recommendation on how long of a cap cities should have for short-term rentals. We expect that we will learn a lot about the types of lessor, property types, and neighborhoods that can be most successfully understood and focused on for interventions. An ancillary goal of our work could be to suggest a short-term rentals policy to a city that does not yet have one, such as Atlanta. We expect our analysis and research to position us to evaluate the different policies that some of the cities included in the data are using.

1. <http://www.governing.com/gov-data/economy-finance/housing-affordability-by-city-income-rental-costs.html> [↑](#footnote-ref-0)
2. <https://fivethirtyeight.com/features/airbnb-probably-isnt-driving-rents-up-much-at-least-not-yet/> [↑](#footnote-ref-1)
3. To be determined [↑](#footnote-ref-2)
4. <http://insideairbnb.com/airbnb-vs-rent-city-of-la/> and <http://www.laane.org/wp-content/uploads/2015/03/AirBnB-Final.pdf> [↑](#footnote-ref-3)