

# AirBnB - Disrupting the hotel industry or the housing market?

## Background

AirBnB, a peer-to-peer platform for people to rent out their houses short-term to tourists and visitors in general, have rapidly expanded since it was founded in 2008.

A growing accusation against it is that it's arrival has resulted in people buying multiple homes and listing them on AirBnB short-term instead of renting them long-term in the traditional manner. According to some sources, this is causing housing shortages in some cities but the evidence is mixed.

It is also argued that AirBnB is preventing low-income renters from being able to afford housing because of increasing rent. But again, it is not entirely clear if that's true.

## Objective

1. Chronicle the growth of AirBnB in some of the largest metropolitan statistical areas of the U.S.
2. Specifically, for the Nashville MSA, show the impact of the arrival of AirBnB on the market for home rentals.
3. In particular, compare the profitability of long-term traditional rentals vis-à-vis short-term AirBnB rentals, by location, in the metro Nashville area. This will reveal the locations where the incentives to list on AirBnB are the highest and hence housing shortages are likely to be the greatest.

I build a story map that guides us through this debate. What follows is a description of the methods and data sources used to create each page of the story map and the data layers used in these page. The links to the story map and data sources are in the Data Appendix.

## Methods

### Page: AirBnB in 2009

Detailed AirBnB listings data from [insideairbnb.com](http://insideairbnb.com) provides a field "first time reviewed" which is the date on which a listing was reviewed by a guest on AirBnB for the first time. This allows me to sort the listings by when they were first put up on AirBnB. Barring the odd exceptions when a listing has been around for a long time, say since 2009, but only got reviewed for the first time much later in 2013 for example, this field accurately captures the expansion of AirBnB. Steps I needed to get the data on to the Story Map:

1. The original listings files are in csv format, which I used to tabulate the accumulated number of listings for each U.S. city data is available, using the "first time reviewed" field.
2. The csv files also contained latitudes and longitudes of the listings. I added the csv file to ArcGIS and plotted the coordinates.

3. I exported the csv to a feature class within ArcGIS.
4. I projected the feature class into the *NAD\_1983\_StatePlane\_Tennessee\_FIPS\_4100* Projected Coordinate System.
5. I changed the Data Frame to the same coordinate system.
6. I re-exported it to a shapefile and added the shapefile to the story map.
7. In the Story Map, I used proportional symbols and classified the number of listings into equal intervals.

#### [Page: Fast forward, 7 years later...](#)

I followed the exact same steps with the exception that the accumulated listings were as of 2016 and not as of 2009, and as a result the intervals were much larger.

#### [Page: A closer look at our focus city](#)

Here, after exporting the shapefile for the Nashville listings to the story map, I do not use proportional symbols but rather show individual listings that the larger scale allows. The listings are classified by type: private room or entire home/apt.

#### [Page: Growth at a rapid pace](#)

Same as in the previous page except of course now there's thousands of listings on the map as opposed to just a few. The classification is still the same although now a third category "shared room" shows up.

#### [Page: The incentive to host on AirBnB](#)

1. I downloaded the census tract boundary shapefile from the U.S. Census for the state of Tennessee.
2. I added the feature class for the boundary of Davidson County, which contains most of the Nashville metro area, from the gis data that we were provided for our GIS class.
3. I used the 'intersect' tool to keep the census tracts within Davidson County. 'Select by Attribute' was not possible since the census tracts shapefile did not have a county field or city field. I did not use the 'clip' feature since I needed the county fields for later analysis and 'clip' would have dropped those.
4. I used 'spatial join' to join the airbnb listings data with the census tracts. I used 'points to polygons' and summarized the listings fields such as bedrooms, nightly price etc. by average for each census tract.
5. I downloaded median rent data for census tracts from the U.S. Census and used a 'one-to-one join' to join the census tracts feature class with the median rent csv basing the join on the tract FIPS code *geoid*.
6. I added a field "days\_breakeven" and used the field calculator to generate the values as follows: median rent / listing nightly price. An example of such a calculation is in the story map.
7. I exported a shapefile version of the feature class to Story Maps and classified the "days\_breakeven" into equal intervals for display.

### Page: So, is there really a shortage?

Using two more datasets from the U.S. Census – Vacancy Status for the years 2009 and 2015 – I computed the change in the percentage of owner-vacant property that is made available for rent long-term to tenants (denoted `rent_pc` in my analysis):

1. I used a 'one-to-one join' to join the census tracts feature class with the vacancy rate csv file for 2009, basing the join on the tract FIPS code *geoid*, and similarly for the file for 2015.
2. I added a field "chg\_in\_avail" and used the field calculator to generate the values as follows:  
 $\text{rent\_pc\_2015} - \text{rent\_pc\_2009}$ .
3. I exported a shapefile version of the feature class to Story Maps and classified the "chg\_in\_avail" into three groups for display – one for negative values, one for positive values and one for zeros to put the map in stark contrast.

### Page: And is rent really increasing?

Using the median contract rent datasets for the years 2009 and 2015, I obtained the change in rent:

1. I used a 'one-to-one join' to join the census tracts feature class with the median rent csv file for 2009, basing the join on the tract FIPS code *geoid*, and similarly for the file for 2015.
2. I added a field "chg\_med\_rent" and used the field calculator to generate the values as follows:  
 $\text{med\_rent\_2015} - (\text{med\_rent\_2009} * 1.1267)$   
The median rent of 2009 is adjusted for inflation by multiplying by the percentage change in the CPI from 2009 to 2015.
3. I exported a shapefile version of the feature class to Story Maps and classified the "chg\_med\_rent" into three groups for display – one for negative values, one for positive values and one for zeros to put the map in stark contrast.

### Page: Conclusion

I develop the rankings following these steps:

1. Convert the feature class containing the change in median rent etc. into 4 rasters using 'Feature to Raster':
  - a. One using 'chg\_med\_rent' as field
  - b. One using 'chg\_in\_avail' as field
  - c. One using 'hhi' as field
  - d. One using 'days\_breakeven' as field
2. Reclassify, using the reclassify tool, each of the above rasters in ones with simple 3-class rankings. Interpretation of the rankings is described in the story map.
3. Use the map algebra → raster calculator to add the 4 separate ranks to obtain a composite rank.
4. Convert the resulting composite rank raster into a feature class using the 'Raster to Polygon' tool.
5. Export the resulting feature class into a shapefile.

6. Add the shapefile to the story map and classify the composite rank into 7 groups, one for each rank since the rankings go from 6 to 12.

I got median household income (hhi) data from the U.S. Census.

## Problems encountered

1. The census tracts from the census tract boundary shapefile from the U.S. census did not all match up with the ones in the csv files containing median rent and vacancy rate data. Given the fact the files are for the same years (either 2009 in both cases or 2015 in both cases) and given that the source is the same (U.S. census in both cases), it is strange that they do not match up. The boundary shapefile had more census tracts which I manually removed.
2. ArcGIS kept on giving errors when converting shapefiles into rasters until I moved both the shapefiles and the destination folder for the output rasters to a folder whose path had no spaces in them.
3. Some fields should have had null values in the shapefiles but were recorded as zeros. I failed to convert them to null values. I googled and found out that shapefiles do not allow null values.

## Data Appendix

Item	Source
Story Map	<a href="http://arcg.is/2h74Edg">http://arcg.is/2h74Edg</a>
LA Times - Airbnb and other short-term rentals worsen housing shortage, critics say	<a href="http://www.latimes.com/business/realestate/la-fi-airbnb-housing-market-20150311-story.html">http://www.latimes.com/business/realestate/la-fi-airbnb-housing-market-20150311-story.html</a>
US News - What's Causing the Housing Shortage in Your Hometown?	<a href="http://realestate.usnews.com/real-estate/articles/whats-causing-the-housing-shortage-in-your-hometown/">http://realestate.usnews.com/real-estate/articles/whats-causing-the-housing-shortage-in-your-hometown/</a>
Airbnb Pushes Up Apartment Rents Slightly, Study Says	<a href="http://blogs.wsj.com/developments/2015/03/30/airbnb-pushes-up-apartment-rents-slightly-study-says/">http://blogs.wsj.com/developments/2015/03/30/airbnb-pushes-up-apartment-rents-slightly-study-says/</a>
LA Times - Activists say Airbnb drives up rents. But is that actually true? L.A. needs to find out	<a href="http://www.latimes.com/opinion/op-ed/la-oe-0513-yaffe-airbnb-ordinance-la-20160513-story.html">http://www.latimes.com/opinion/op-ed/la-oe-0513-yaffe-airbnb-ordinance-la-20160513-story.html</a>
AirBnB image	<a href="https://techcrunch.com/2015/10/21/that-airbnb-ad/">https://techcrunch.com/2015/10/21/that-airbnb-ad/</a>
Graph on multiple-listings hosts	<a href="https://www.airdna.co/city/us/tennessee/nashville">https://www.airdna.co/city/us/tennessee/nashville</a>
AirBnB detailed listings data, all cities	<a href="http://insideairbnb.com/get-the-data.html">http://insideairbnb.com/get-the-data.html</a>
Tennessee census tracts	<a href="https://www.census.gov/geo/maps-data/data/cbf/cbf_tracts.html">https://www.census.gov/geo/maps-data/data/cbf/cbf_tracts.html</a>
Median contract rent	<a href="http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_15_5YR_B25058&amp;prodType=table">http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_15_5YR_B25058&amp;prodType=table</a>
Vacancy rate	<a href="http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_15_5YR_B25004&amp;prodType=table">http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_15_5YR_B25004&amp;prodType=table</a>
Median household income	<a href="http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_15_5YR_B19013&amp;prodType=table">http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_15_5YR_B19013&amp;prodType=table</a>