Final Capstone Project: Analyzing Venue Information based on Urban Index Values

KYLE PHILLIPS, FINAL CAPSTONE PROJECT 2021

Introduction and Business Problem

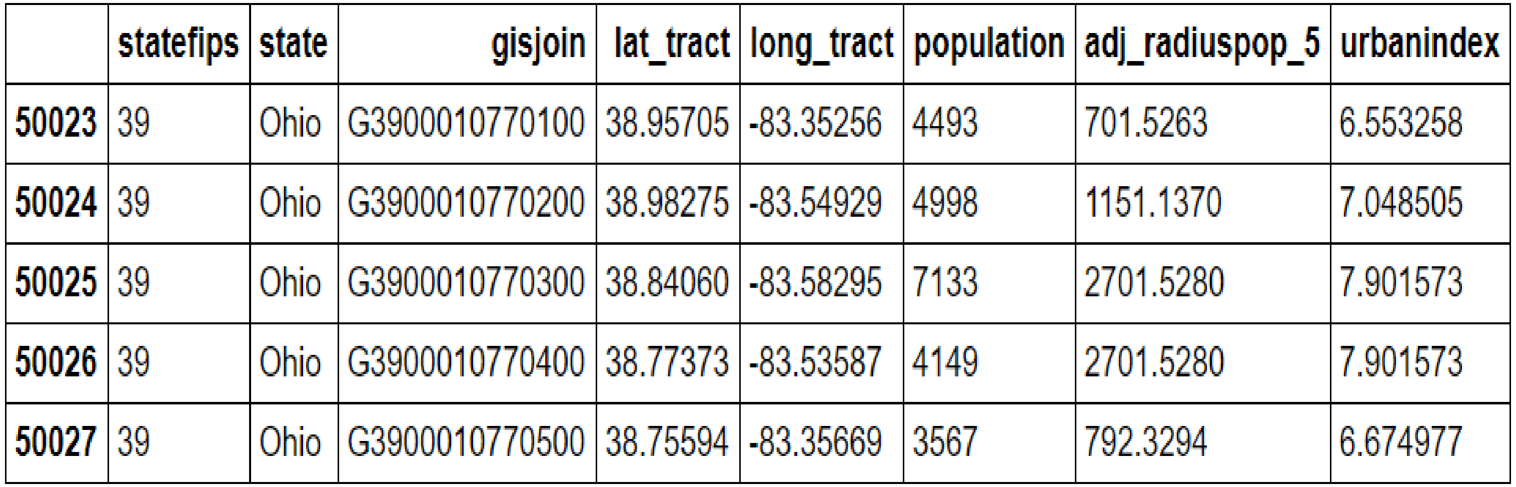
- Imagine that a development company has several tracts of recently zoned farmland, but also recently acquired some vacant lots in a re-emerging area of a large city.
- What types of venues are common in the rural areas that might do well on the farmland?
- What types of venues are popular in the urban downtowns of populous places?
- How could someone find out what is already out there?

Data Sources

- There were 2 main sources of data used in this analysis.
- Using a publicly available dataset from FiveThirtyEight (https://github.com/fivethirtyeight/data/tree/master/urbanization-index), it was possible to examine latitudes and longitudes by state, and also by what the people at FiveThirtyEight are calling the "urban index."
- Foursquare data was also utilized for this analysis to gather venue information for each latitude and longitude

Data Cleaning

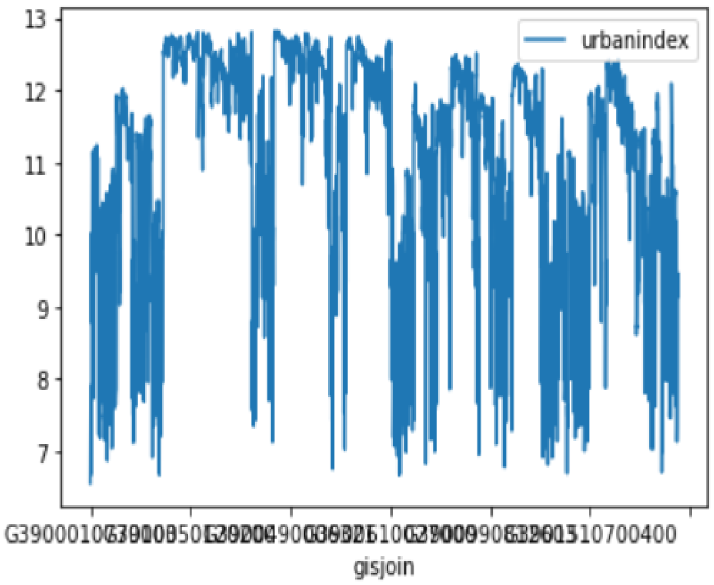
- The data was pared down to the target state, Ohio.
- The data contained in the final set included all 2940 census tracts from the state.

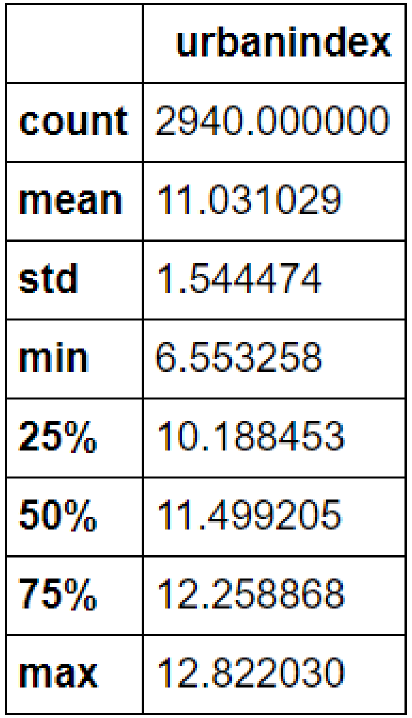


	statefips	state	gisjoin	lat_tract	long_tract	population	adj_radiuspop_5	urbanindex
50023	39	Ohio	G3900010770100	38.95705	-83.35256	4493	701.5263	6.553258
50024	39	Ohio	G3900010770200	38.98275	-83.54929	4998	1151.1370	7.048505
50025	39	Ohio	G3900010770300	38.84060	-83.58295	7133	2701.5280	7.901573
50026	39	Ohio	G3900010770400	38.77373	-83.53587	4149	2701.5280	7.901573
50027	39	Ohio	G3900010770500	38.75594	-83.35669	3567	792.3294	6.674977

Methodology

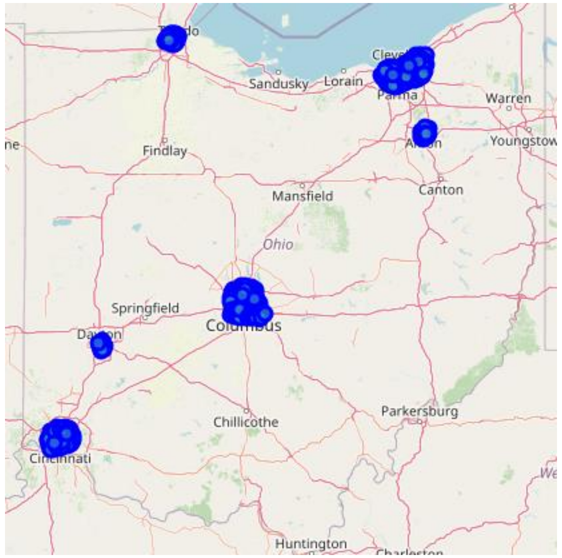
- The first step was trying to determine what number of urban index indicated the most urban areas for the analysis (the highest on the index) and the most rural (the lowest).
- The first step to finding out was to graph the data and see if that provided any insights.
- The descriptive statistics of the data frame were much more useful.

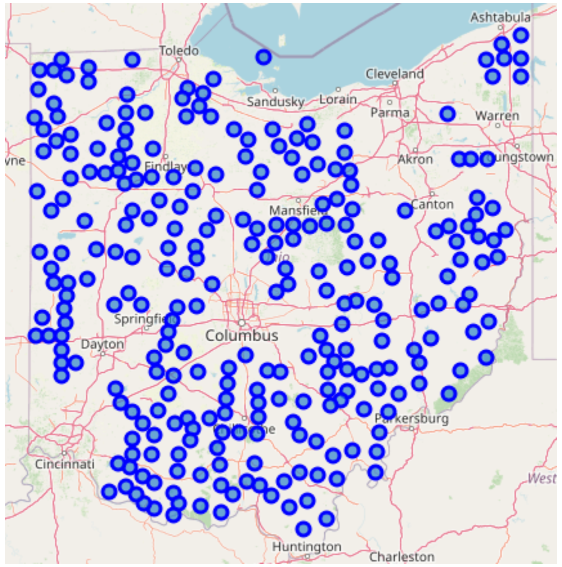




	urbanindex
count	2940.000000
mean	11.031029
std	1.544474
min	6.553258
25%	10.188453
50%	11.499205
75%	12.258868
max	12.822030

Methodology

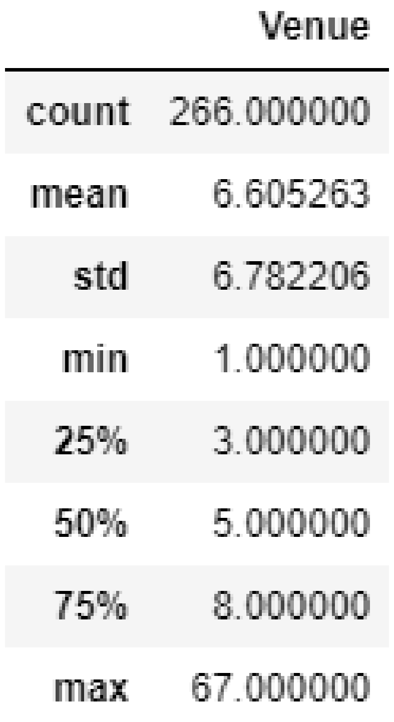




- The areas were mapped iteratively until they covered a good cross section of the urban areas in the state. The final value ended up covering 706 census tracts. This is any area with an urban index number over 12.28.
- The process was repeated for the rural tracts. The concern here is not so much the regionality of the data, but the lack of venues in rural areas to make an adequate sample. The rural sample was also expanded iteratively until the sample covered a good cross section of the state. The final boundary for rural census tracts ended up at 8.

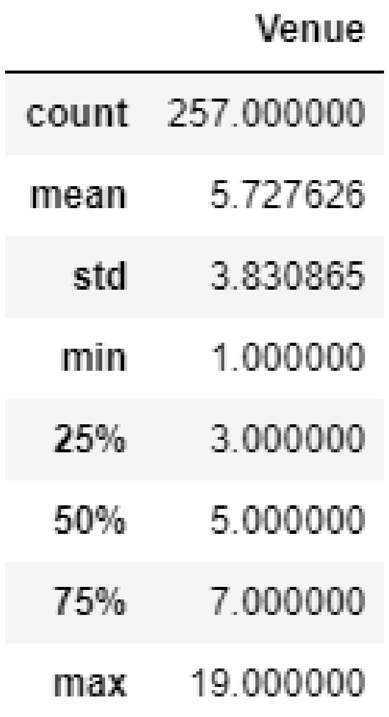
Methodology

- The next step was pulling venue information for the rural and urban data sets.
- The first step was defining the function to get information and then running it for each of the data sets. The rural data set was first. On a first pass, there were 1757 locations in 273 locations.
- However, initially the standard deviation was high and the difference in the average location and the max was very large.
- To make a more homogenous data set, any location with more than 20 venues was dropped.



	Venue
count	266.000000
mean	6.605263
std	6.782206
min	1.000000
25%	3.000000
50%	5.000000
75%	8.000000
max	67.000000

BEFORE

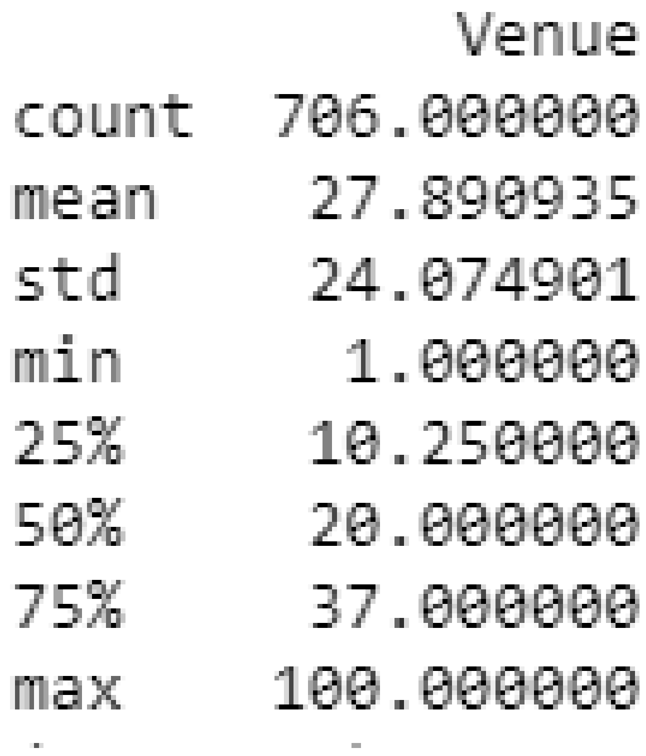


	Venue
count	257.000000
mean	5.727626
std	3.830865
min	1.000000
25%	3.000000
50%	5.000000
75%	7.000000
max	19.000000

AFTER

Methodology

- The next step was to find the venue information for the urban data. The radius used for the rural data was 5km, the net had to be cast wide to find rural venues. For the urban areas, locations would start to overlap if the radius was 5km, so 1km was used instead.
- There were 19691 venues in the urban set, again this is to be expected, with more people, there are inherently more places.
- There are outliers in this data set as well, but with so many venues, the information is unlikely to skew the results.



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            Venue
count  706.000000
mean    27.890935
std     24.074901
min      1.000000
25%     10.250000
50%     20.000000
75%     37.000000
max    100.000000
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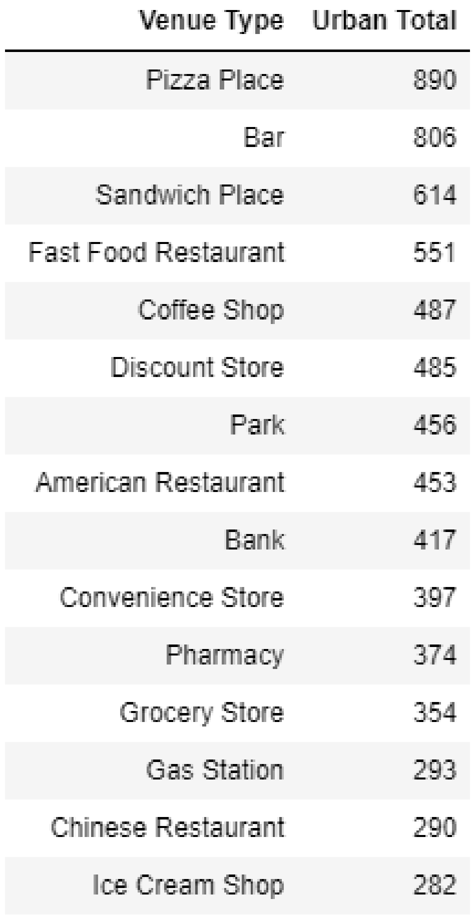
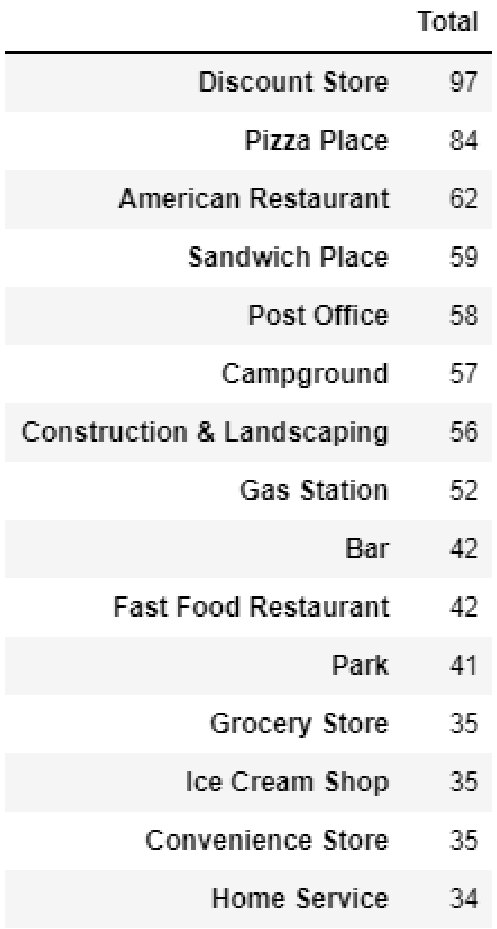
Results

- There are 448 unique categories of venues in the urban areas and 199 unique types of venues in the rural areas.
- **The top types of venues for each area are included here.**



Venue Type	Urban Total
Pizza Place	890
Bar	806
Sandwich Place	614
Fast Food Restaurant	551
Coffee Shop	487
Discount Store	485
Park	456
American Restaurant	453
Bank	417
Convenience Store	397
Pharmacy	374
Grocery Store	354
Gas Station	293
Chinese Restaurant	290
Ice Cream Shop	282

URBAN VENUES

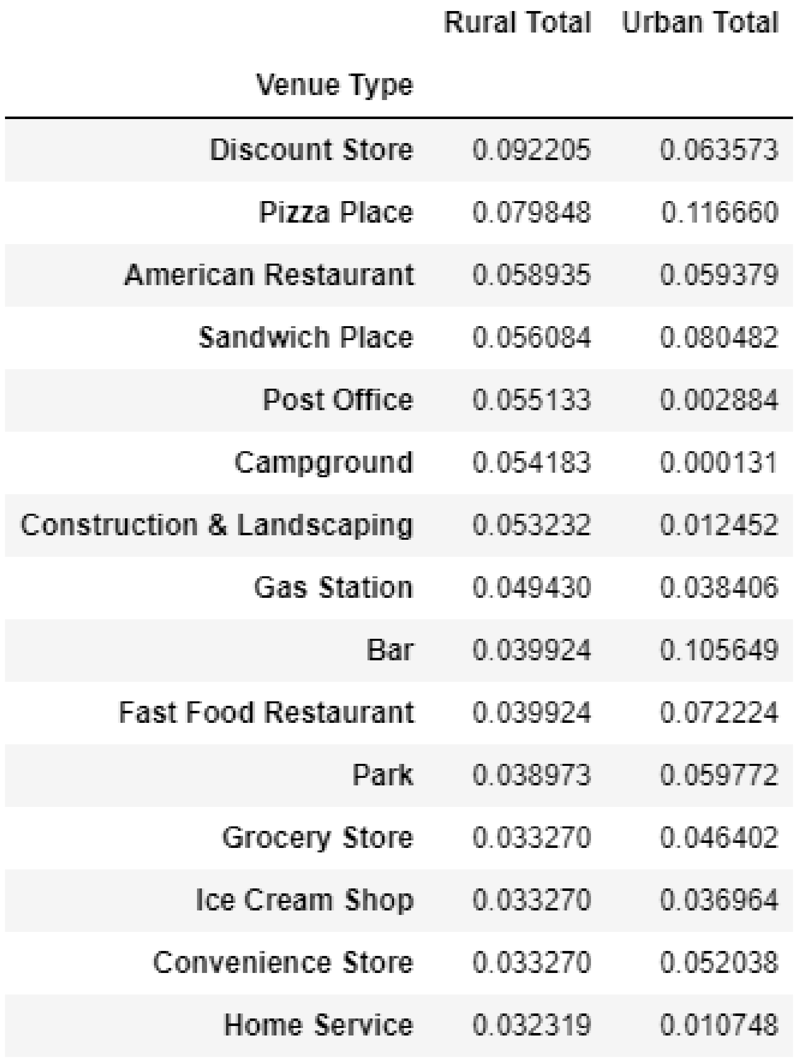


	Total
Discount Store	97
Pizza Place	84
American Restaurant	62
Sandwich Place	59
Post Office	58
Campground	57
Construction & Landscaping	56
Gas Station	52
Bar	42
Fast Food Restaurant	42
Park	41
Grocery Store	35
Ice Cream Shop	35
Convenience Store	35
Home Service	34

RURAL VENUES

Results

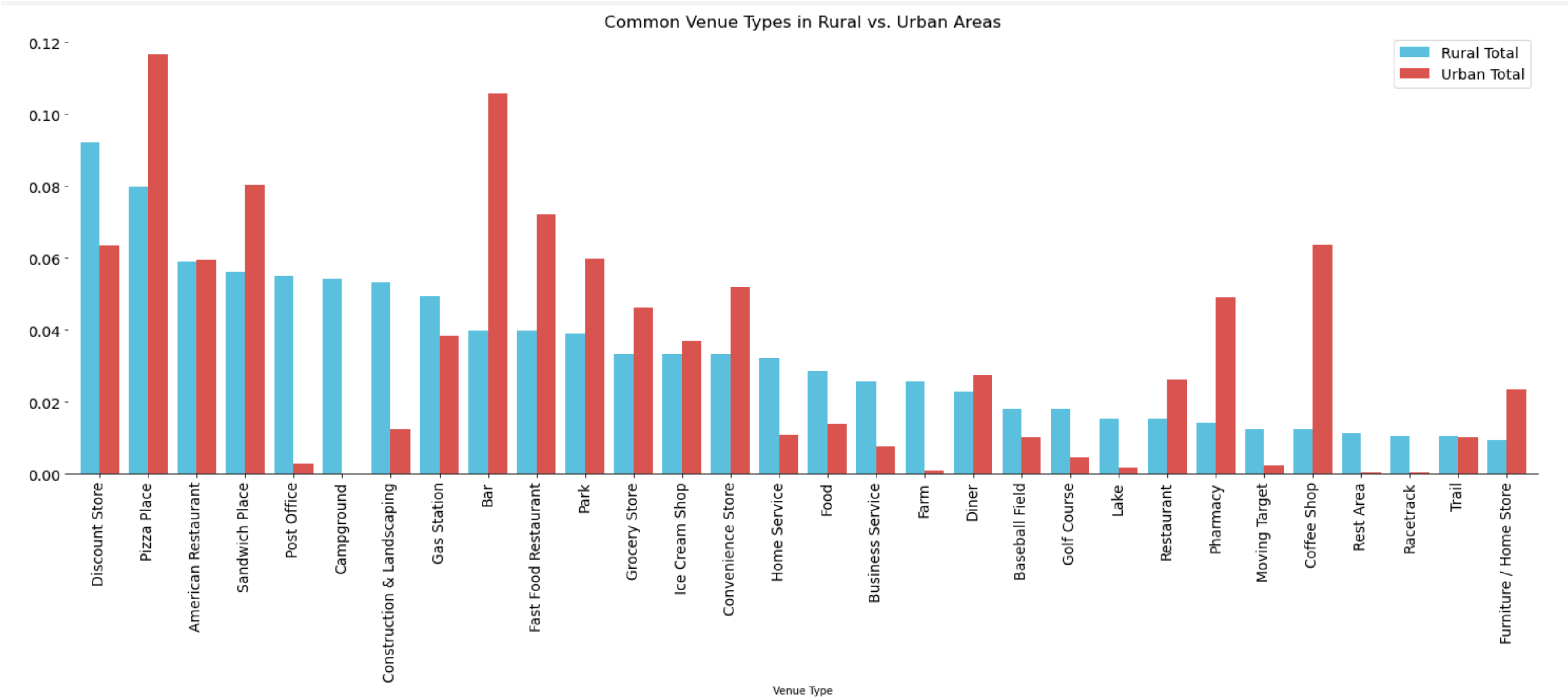
- To be able to compare the data, it had to be normalized. I chose to do this simply, by dividing each category by the total number of venues. A sample of the normalized data is included here.



	Rural Total	Urban Total
Venue Type		
Discount Store	0.092205	0.063573
Pizza Place	0.079848	0.116660
American Restaurant	0.058935	0.059379
Sandwich Place	0.056084	0.080482
Post Office	0.055133	0.002884
Campground	0.054183	0.000131
Construction & Landscaping	0.053232	0.012452
Gas Station	0.049430	0.038406
Bar	0.039924	0.105649
Fast Food Restaurant	0.039924	0.072224
Park	0.038973	0.059772
Grocery Store	0.033270	0.046402
Ice Cream Shop	0.033270	0.036964
Convenience Store	0.033270	0.052038
Home Service	0.032319	0.010748

Results

- The data was plotted against each other to be able to see how different types of venues are distributed in urban and rural areas.



Conclusions

- If someone or some company were trying to decide what type of venue to build in Ohio, a good place to start would be a pizza place.
- In urban Ohio, there are also a significant number of bars, sandwich shops, fast food places, and coffee shops.
- While in rural Ohio, the top spots are held by discount stores, pizza places, American restaurants, and sandwich shops.

Further Analysis

- A potential next step for this analysis would be to build a predictive model based on the urban index and see if it would be possible to predict the type of venue that is most prevalent based solely on the urban index number for a location.
- It would also be an interesting analysis to see how other states urban and rural areas compare to Ohio. Is pizza ubiquitous in the US, or just the Midwest? How do different regions of the country compare?
- Another question that begs answering is around suburban regions. Do regions that are not urban or rural follow the same patterns?