HOMELESSNESS & AIRBNB IN IRELAND

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IBM DATA SCIENCE CAPSTONE PROJECT

1. Introduction/Business Problem

In the last number of years, the topic of homelessness has become a political and news topic in Ireland. The charity Focus Ireland says that there were 10,448 people homeless across Ireland at the end of 2019, and that the number of homeless families has increased by over 300% since November 2014. In the early 2000's Ireland experienced a property bubble during the so called "Celtic Tiger" era, followed by a property crash in the 2008 global economic downturn

Since then the economy has recovered however rate of new house builds have not kept up with the demand resulting in fewer available rental properties. One of the many factors cited as influencing the availability of rental properties (and as a result homelessness) is the rise in the number of properties being used for short term rental on Airbnb. In mid 2019 the Irish government enacted the Residential and Tenancies Act 2019 place restrictions to short-term letting in Rent Pressure Zones. Registrations are limited properties rented out for 90 days or less per year.

In this study I will analyse Airbnb rentals and homelessness in two Irish cities: (1) Dublin which is the capital and largest city in Ireland and the city in which I was born. (2) Cork which is the second largest city in Ireland and the city in which I currently live and work. The analysis will be used to determine if any insights linking Airbnb to levels of homelessness can be found and to understand if any properties in Rent Pressure Zones for more than 90 days per year. In addition, the foursquare API will be used to investigate venues close to the areas of high density of Airbnb listings to try to understand why these areas are popular.

This analysis may be of interest to social scientists, local government and charities involved in providing aid to the homeless.

2. Data

Based on the problem of interest, the information of interest relates to homelessness and Airbnb rentals in the cities of Dublin and Cork. The Foursquare location data and clustering analysis will be used to visualize relevant Airbnb listings in Rent Pressure Zones in Dublin and Cork. The following data sources will be used to extract the required information and to generate insights:

(1) - Airbnb listings for Dublin and Cork which can be downloaded from the Inside Airbnb website linked below: http://insideairbnb.com/get-the-data.html This data includes useful information such as neighbourhood where the property is located (neighbourhood), latitude and longitude, type of property (room_type) as well as number of days per year that the property is available (Availability).

(2) - Official homelessness figures from the Irish Government, Department of Housing, Planning and Local Government available from the website linked below: https://www.housing.gov.ie/housing/homelessness/other/homelessness-data. This data includes numbers of homeless people in Ireland broken down by county.

(3) – Information on venues was obtained using the Foursquare API: https://foursquare.com/

(4) - New dwelling completion data was taken from the Irish Central Statistics Office website linked below: https://www.cso.ie/en/. This data set provides the number of new dwellings completed in Ireland every year.

3. Methodology

3.1 Exploratory Data Analysis

The first exploratory analysis was carried out to understand the trends in homeless in Ireland and then specifically in the cities of Dublin and Cork. Official homelessness figures were obtained from the Irish Government, Department of Housing, Planning and Local Government. However, as the data was in the form pdf reports, it was not possible to scrape the data and the pandas dataframe of numbers of homeless in Ireland, Dublin and Cork (Figure 1) was generated manually from the data in the pdf reports.

	Year	Ireland Homeless	Dublin Homeless	Cork Homeless
0	2014	2858	1868	194
1	2015	3625	2506	205
2	2016	4643	3162	258
3	2017	5508	3172	287
4	2018	6194	4175	373
5	2019	6696	4534	447

Figure 1 -Pandas Dataframe of Homeless Numbers in Ireland

The homeless data was then visualized in time series plots. As can be seen from both the dataframe above and the plots (figures 2 and 3) below, the number of homeless in Ireland, Dublin and Cork has more than doubled in the 2014-2019 timeframe.
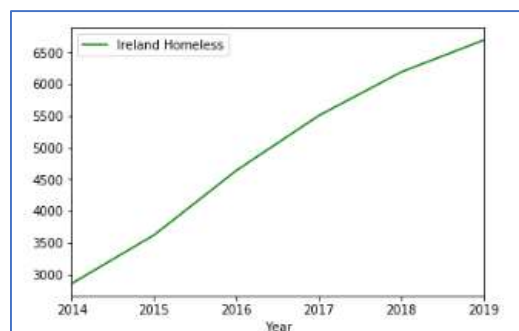

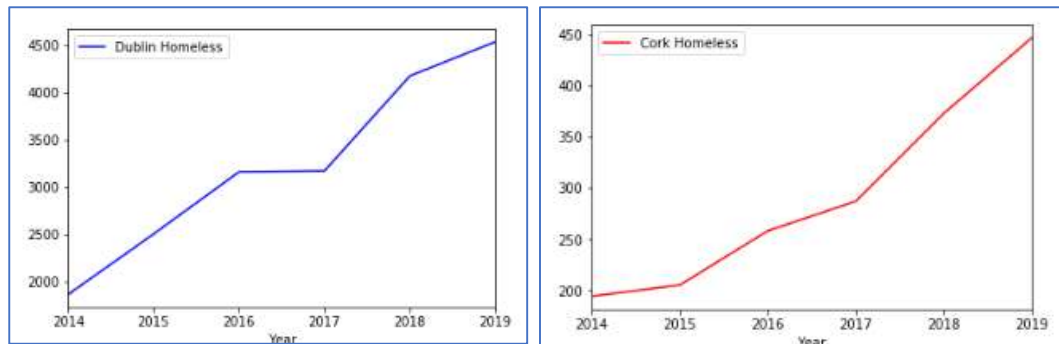*Figure 2 Homeless Numbers in Ireland 2014-2019*

Figure 3 Homeless Numbers in Dublin and Cork 2014-2019

The second exploratory analysis was carried out to understand the trends in new dwelling completions in Ireland. New dwelling completion data was taken from the Irish Central Statistics Office. Data from years 2000-2012 was downloaded from a excel file on the website and converted into a pandas dataframe. Data from years 2013-2019 was in pdf report format so a pandas dataframe had to be generated manually. Both dataframes were then merged to generate the final dataframe of new dwelling completions 2000-2019 (figure 4). The data was visualized by generating a time series plot. It is clear from the dataframe and time series plot that there was a property bubble in the early 2000's peaking at over 88,000 new dwelling completions in 2006. The property crash began in 2008 and hit a low of 4,575 in 2013 before slowly creeping up in the years 2014-2019. In 2019 the number of new dwelling completions reached 19,685 (much lower than the peaks seen during the Irish property boon of the early 2000's).
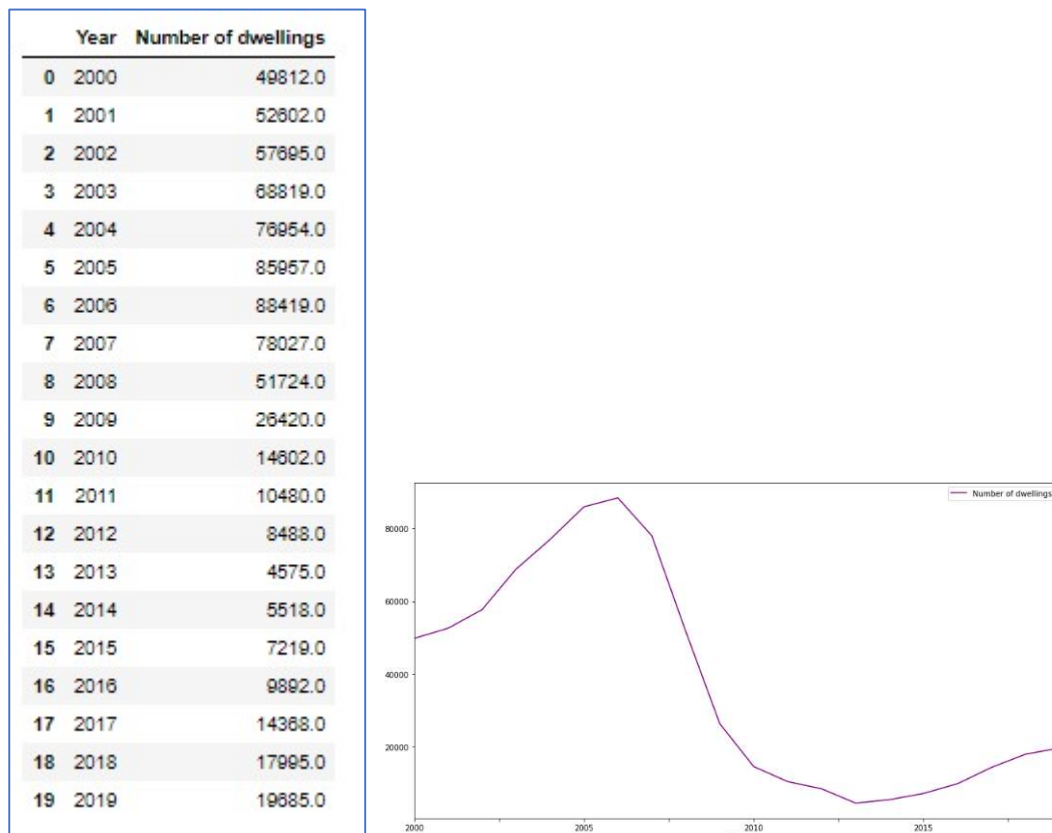
	Year	Number of dwellings
0	2000	49812.0
1	2001	52602.0
2	2002	57695.0
3	2003	68819.0
4	2004	76954.0
5	2005	85957.0
6	2006	88419.0
7	2007	78027.0
8	2008	51724.0
9	2009	26420.0
10	2010	14602.0
11	2011	10480.0
12	2012	8488.0
13	2013	4575.0
14	2014	5518.0
15	2015	7219.0
16	2016	9892.0
17	2017	14368.0
18	2018	17995.0
19	2019	19685.0

Figure 4 New Dwelling Completions Ireland 2000-2019

The third exploratory data analysis was carried out on Airbnb Listings in Cork and Dublin. The Dublin Airbnb listings were available from the insideairbnb website. The data was downloaded and converted to a pandas dataframe. As the study was interested in full properties that could potentially be used to house homeless people, listings related to single rooms were eliminated from the dataframe. The following columns were eliminated from the dataframe as they were not of interest for the study:

'host_name', 'neighbourhood_group', 'minimum_nights', 'number_of_reviews', 'reviews_per_month','last_review', 'calculated_host_listings_count'

A new column called 'max_annual_earning' was added to the pandas dataframe by multiplying the number of available days by the price (figure 5). This gives and indication of how much a landlord can earn from the property if it is occupied for all available days.

There are 2,912 Airbnb listings in Dublin that are full properties (i.e. not individual rooms).

	id	name	host_id	neighbourhood	latitude	longitude	room_type	price	availability_365	max_annual_earnings
0	165828	Pádraig Pearse apt. Kilmainham	790601	Dublin City	53.33630	-6.32439	Entire home/apt	147	280	41160
1	165829	The "Michael Collins" apartment	790601	Dublin City	53.33811	-6.32259	Entire home/apt	135	267	36045
2	200979	"The Lodge, Dalkey Avenue ."	982970	Dn Laoghaire-Rathdown	53.27420	-6.10917	Entire home/apt	220	232	51040
3	237465	Cozy warm Annexe 10 mins to airport. total pri...	1245198	Dublin City	53.39615	-6.17456	Entire home/apt	55	225	12375
4	275425	Luxury family home with all amenities (6 persons)	1357428	Dublin City	53.32670	-6.20921	Entire home/apt	248	33	8184
5	292757	Old World Converted Stableyard with Swimming Pool	1515549	Fingal	53.36958	-6.34959	Entire home/apt	120	144	17280
6	302554	Peaceful retreat for 5 - excellent location	1557844	Dublin City	53.35628	-6.28981	Entire home/apt	180	325	58500
7	302634	Studio sleeps 2 city ctr 10 mins - Molly Malone	1557844	Dublin City	53.35561	-6.29149	Entire home/apt	100	277	27700
8	365854	Boutique Cosy Centre Apartment	1847391	Dublin City	53.35305	-6.25708	Entire home/apt	85	176	14960
9	374792	'Grace Gifford' cottage, Kilmainham	790601	Dublin City	53.33680	-6.32410	Entire home/apt	135	277	37395

Figure 5 Final Dublin Airbnb Listing Dataframe

An analysis was carried out to determine the number of Dublin listings available for more than 90 days for more than 180 days and for 365 days respectively (figure 6)

resolve the homelessness issue. However if we assume that some of the people listed as homeless are family groups, freeing up some of these properties for homeless family long term rental could help alleviate the homelessness issue.

```
In [20]: # Check the number of Dublin Airbnb listings that exceed the 90 day cap for rent pressure zones set by the new Irish government legislation
         dubList90_df = dubListFinal_df[dubListFinal_df['availability_365']>90]
         print(dubList90_df.shape)

         (1462, 10)
```

This is interesting as it indicates that 1,462 of the 2,912 listings (approx. 50%) exceed the 90 day cap set by the new government legislation. This may be due to the law being new and not being fully understood by landlords and not yet being strongly enforced by local government.

```
In [23]: # Check the number of Dublin Airbnb listings that are available more than half the year (180 days)
         dubList180_df = dubListFinal_df[dubListFinal_df['availability_365']>180]
         print(dubList180_df.shape)

         (867, 10)
```

```
In [24]: # Check the number of Dublin Airbnb listings that are availble all year round(365 days)
         dubList180_df = dubListFinal_df[dubListFinal_df['availability_365']==365]
         print(dubList180_df.shape)

         (53, 10)
```

Figure 6 Availability of Dublin listings

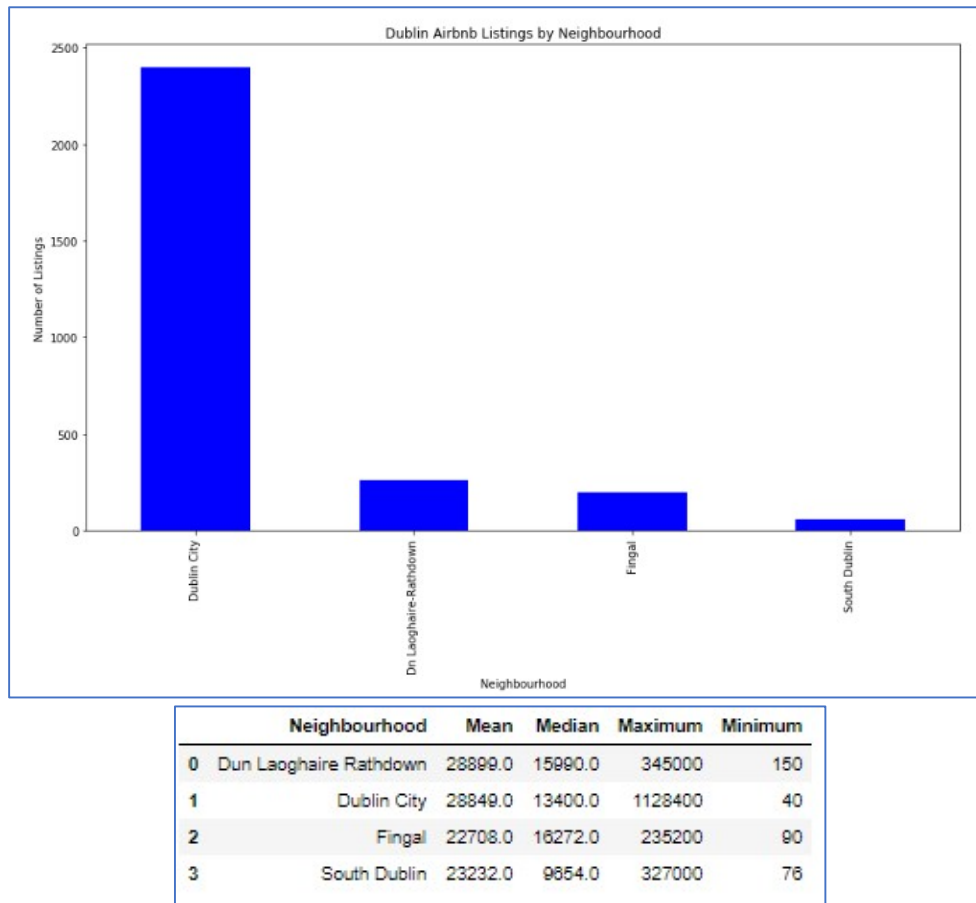A bar chart was used to visualize number of listings by Dublin neighbourhood (figure 7).

Figure 7 Dublin Airbnb listings and Max Earnings by Neighbourhood

The vast majority of Dublin Airbnb Listings are located in the Dublin City Neighbourhood (2,397 of 2,912 properties). The median annual earnings for a property in Dublin city are €13,400 assuming the property is occupied for all of the available days listed on the Airbnb listing.

As Cork is a much smaller city than Dublin, there was no Cork Airbnb listing dataset available. Instead it was necessary to obtain the Cork Airbnb data from an Ireland Airbnb dataset on the insideairbnb website. The Cork listings were extracted by creating a new dataframe where the neighbourhood_group was Cork City Council. As for the Dublin Airbnb listing dataset, listings related to single rooms were eliminated from the dataframe. It was also necessary to eliminate messy suffixes (LEA-6 and LEA-7) from the neighbourhood entries. Finally like with the Dublin dataset, the irrelevant columns were removed and a new column 'max_annual_earnings' added to the dataframe to give the final Cork Airbnb listing dataframe (figure 8).

There are only 178 Airbnb listings in Cork that are full properties (i.e. not individual rooms).

	id	name	host_id	neighbourhood	latitude	longitude	room_type	price	availability_365	max_annual_earnings
0	9548704	modern open plan 2 bed house	49447447	Cork City South Central	51.89126	-8.46324	Entire home/apt	125	342	42750
1	13344373	House in Cork City centre - 3 rooms	58764063	Cork City South Central	51.88995	-8.47027	Entire home/apt	125	168	21000
2	27196730	City centre 1 bedroom apartment own door un...	107437226	Cork City South Central	51.89633	-8.48618	Entire home/apt	85	160	13600
3	3088179	Private Double Room Apartment in the heart of ...	193834	Cork City South Central	51.89269	-8.47284	Entire home/apt	49	184	9016
4	24804603	One bedroom flat in listed Georgian house	907742	Cork City South Central	51.88932	-8.46825	Entire home/apt	52	90	4680
5	38741027	Newly Built 5 Bedroom City Center Apartment	296266292	Cork City South Central	51.89623	-8.47748	Entire home/apt	400	90	36000
6	15388361	9 Magazine rd cork city	56311866	Cork City South Central	51.88914	-8.50054	Entire home/apt	175	37	6475
7	36666968	Gems Place - Modern Apartment.	42822025	Cork City South Central	51.86630	-8.46725	Entire home/apt	76	287	21812
8	17311815	Cork City Centre Bright & Airy 2 Bedroom Duplex	116823097	Cork City South Central	51.89624	-8.46968	Entire home/apt	120	60	7200
9	19499792	Self catering 'Luxury' 1, 2 or3 bedroom Suite	136913954	Cork City South Central	51.89426	-8.49226	Entire home/apt	188	355	66740

Figure 8 Final Cork Airbnb Listings Dataframe

An analysis was carried out to determine the number of Cork listings available for more than 90 days for more than 180 days and for 365 days respectively (figure 9)

```
In [31]: # Check the number of Cork Airbnb Listings that exceed the 90 day cap for rent pressure zones set by the new Irish government legislation
corList90_df = corListFinal_df[corListFinal_df['availability_365']>90]
print(corList90_df.shape)

        (119, 10)
```

Interestingly, 119 of the 178 listings (approx. 67%) exceed the 90 day cap set by the new government legislation. This may be due to the law being new and not being fully understood by landlords and not yet being strongly enforced by local government.

```
In [32]: # Check the number of Cork Airbnb Listings that are available more than half the year (180 days)
corList180_df = corListFinal_df[corListFinal_df['availability_365']>180]
print(corList180_df.shape)

        (75, 10)
```
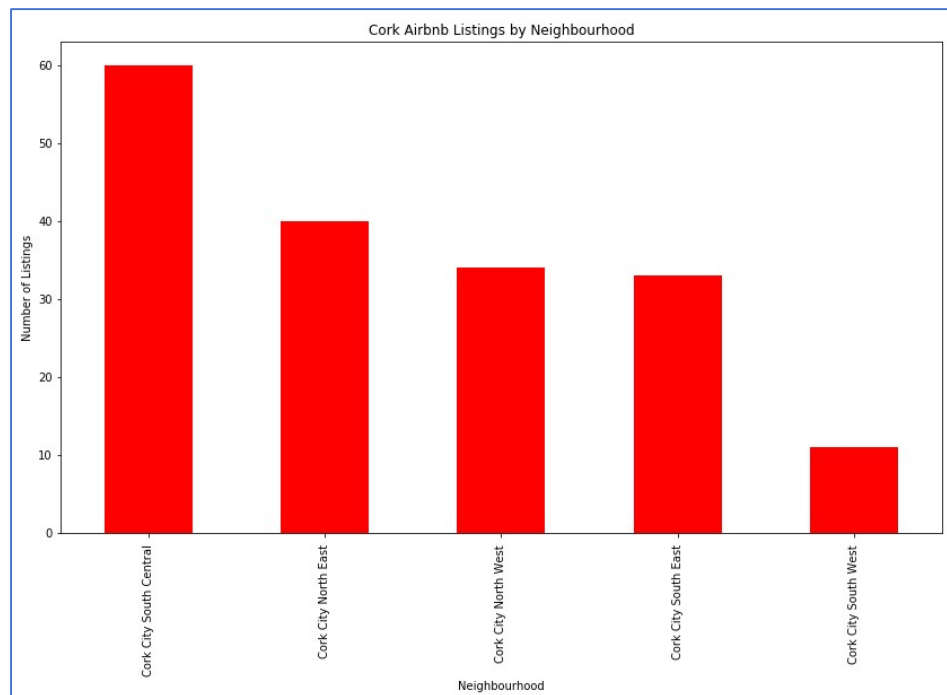
```
In [33]: # Check the number of Cork Airbnb Listings that are available all year round (365 days)
corList365_df = corListFinal_df[corListFinal_df['availability_365']==365]
print(corList365_df.shape)

        (0, 10)
```

Figure 9 Cork Airbnb Listings Availability

	Neighbourhood	Mean	Median	Maximum	Minimum
0	Cork City North East	26679.0	26679.0	122150	70
1	Cork City North West	20056.0	20056.0	84250	325
2	Cork City South Central	21003.0	21003.0	109800	639
3	Cork City South East	21377.0	21377.0	60400	524
4	Cork City South West	23515.0	23515.0	110360	120

Figure 10 Cork Airbnb Listings & Max Earnings by Neighbourhood

The Airbnb are spread more evenly across the five Neighbourhoods in Cork than in Dublin. The largest number of Cork Airbnb Listings are located in the Cork City South Central Neighbourhood y of 178 properties). The median annual earnings for a property in this neighbourhood is €21,003 assuming the property is occupied for all of the available days listed on the Airbnb listing. The reason that the earnings in Cork are greater than in Dublin are not due to higher prices (in actual fact the prices are lower in Cork than in Dublin) but to a higher number of available days per year.

3.2 Clustering Analysis of Airbnb Listings in Dublin and Cork

In order to visualize the Airbnb listings in Dublin, a folium map was generated with markers for each of the Airbnb listings in Dublin (figure 11). As the dataset was too large for the folium map, it was necessary to limit the data points to 1,000 of the 2,912 listings.
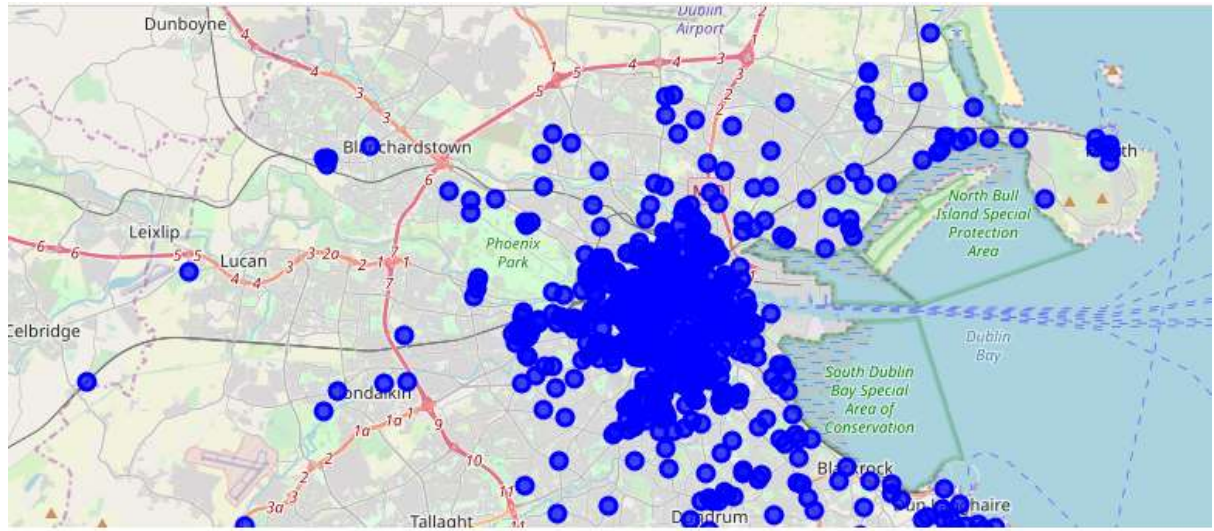
Figure 11 Folium map of Dublin with markers for Airbnb listings

It was decided to perform cluster analysis of the Dublin Airbnb listings using a k means algorithm to identify Neighbourhoods with Dublin City where there were high densities of Airbnb Listings. An elbow curve was generated to determine the number clusters to use. Based on the elbow curve I decided to use 5 clusters.
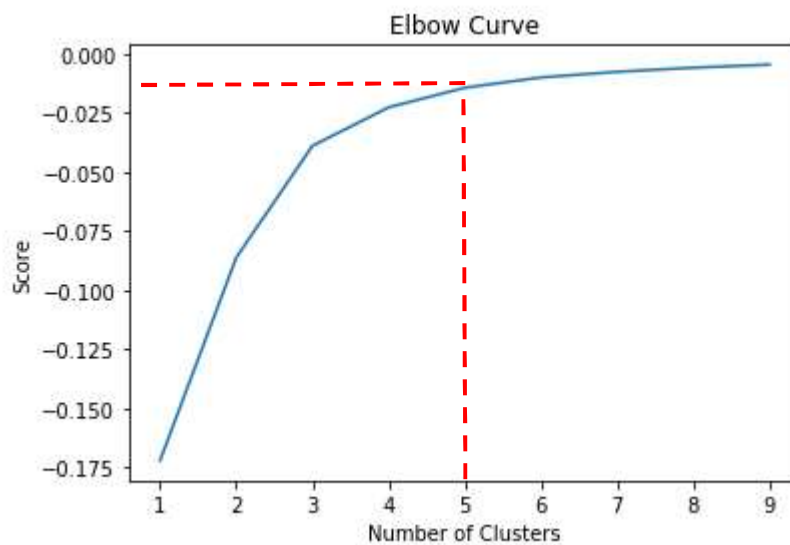

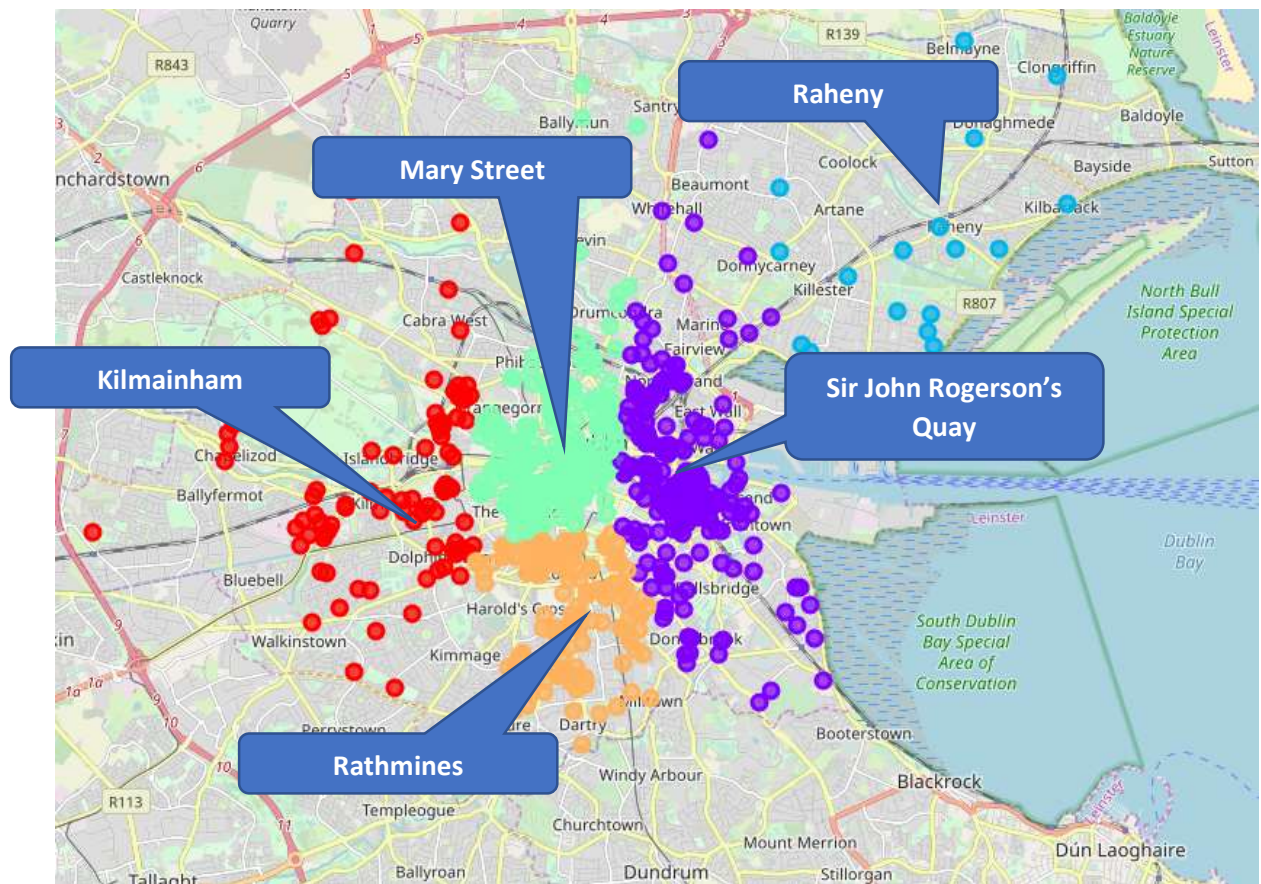*Figure 12 Elbow Curve to determine number of clusters for Dublin*

Figure 13 Dublin map with clusters

The cluster analysis shows 5 clusters centred around Mary Street, Kilmainham, Rathmines, Sir John Rogerson's Quay and a smaller cluster at Raheny. Rather than explore all venues, it was decided to explore three venues that looked particularly popular to see what makes them so popular with Airbnb clients - Mary Street, Sir John Rogerson's Quay and Rathmines.

To visualize the Airbnb listings in Cork, a folium map was generated with markers for each of the Airbnb listings in Dublin (figure 14).
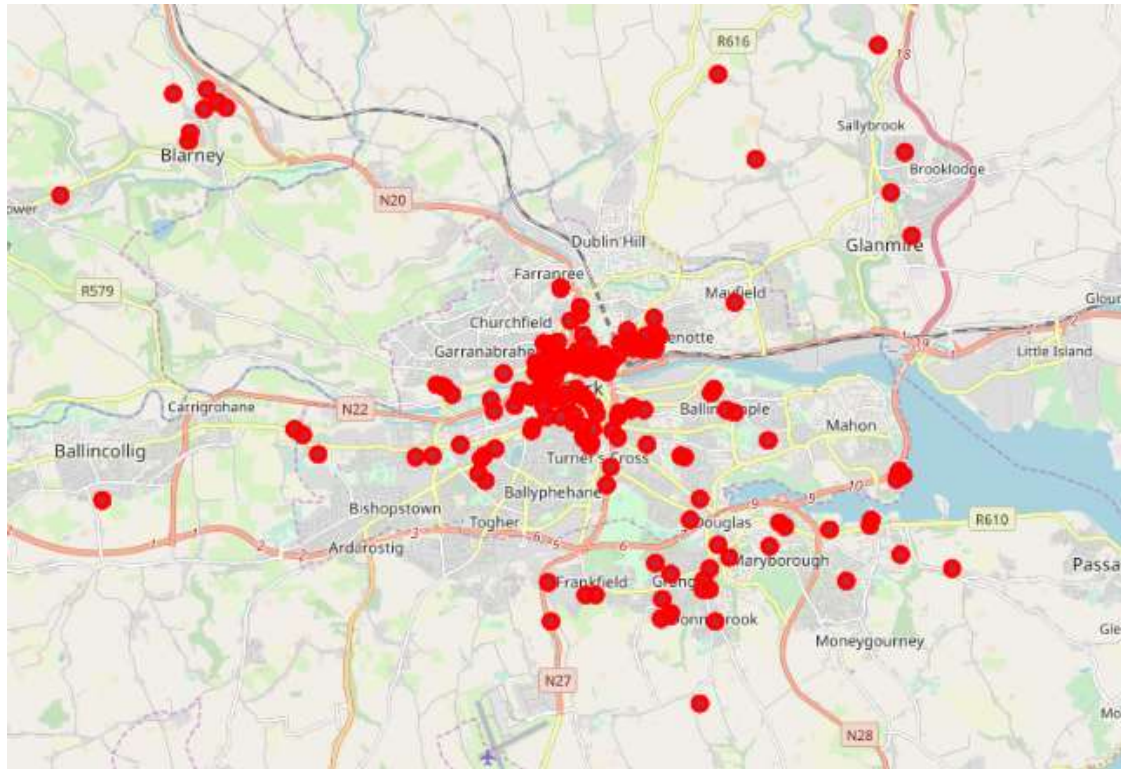
Figure 14 Cork folium map with markers for Airbnb listings

It was decided to perform cluster analysis of the Cork Airbnb listings using a k means algorithm to identify Neighbourhoods in Cork where there were high densities of Airbnb Listings. An elbow curve was generated to determine the number clusters to use. Based on the elbow curve I decided to use 3 clusters.
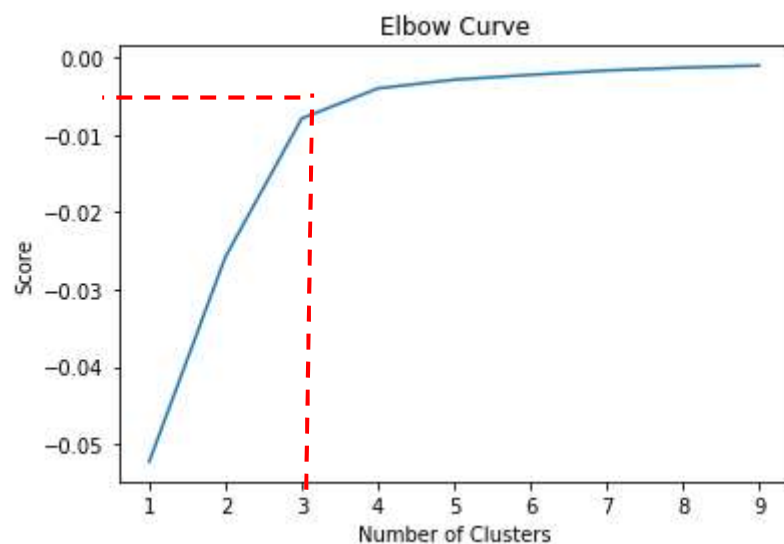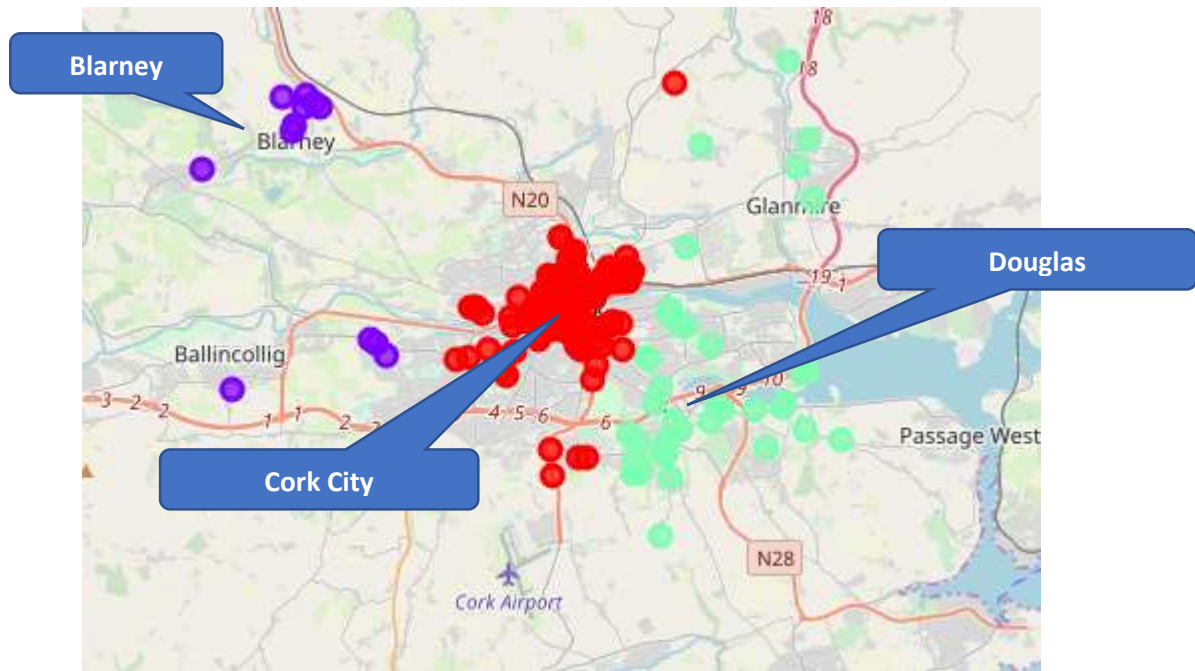
Figure 15 Cork Airbnb Listing Clusters

The cluster analysis shows 3 clusters centred around Cork City Centre, Douglas and a smaller outlying cluster in Blarney.

3.3 Analysis of venues close to centre of Airbnb Listing clusters in Dublin and Cork

Rather than explore venues in all 5 Airbnb clusters in Dublin, it was decided to explore four venues that looked particularly popular to see what makes them so popular with Airbnb clients - Mary Street, Sir John Rogerson's Quay and Rathmines. It was decided not to study the Raheny cluster as the number of listings was so much smaller.

For each of the four clusters, the following steps were taken:

(1) – Use geopry library to get the geographical coordinates for the Neighbourhood
(2) - Access the Foursquare API and create the API request url to search for venues near the location
(3) – Convert the json file to a pandas dataframe
(4) – Eliminate unnecessary columns from the dataframe
(5) – Create a bar chart to show the categories of venues for the location.

Mary Street Venues

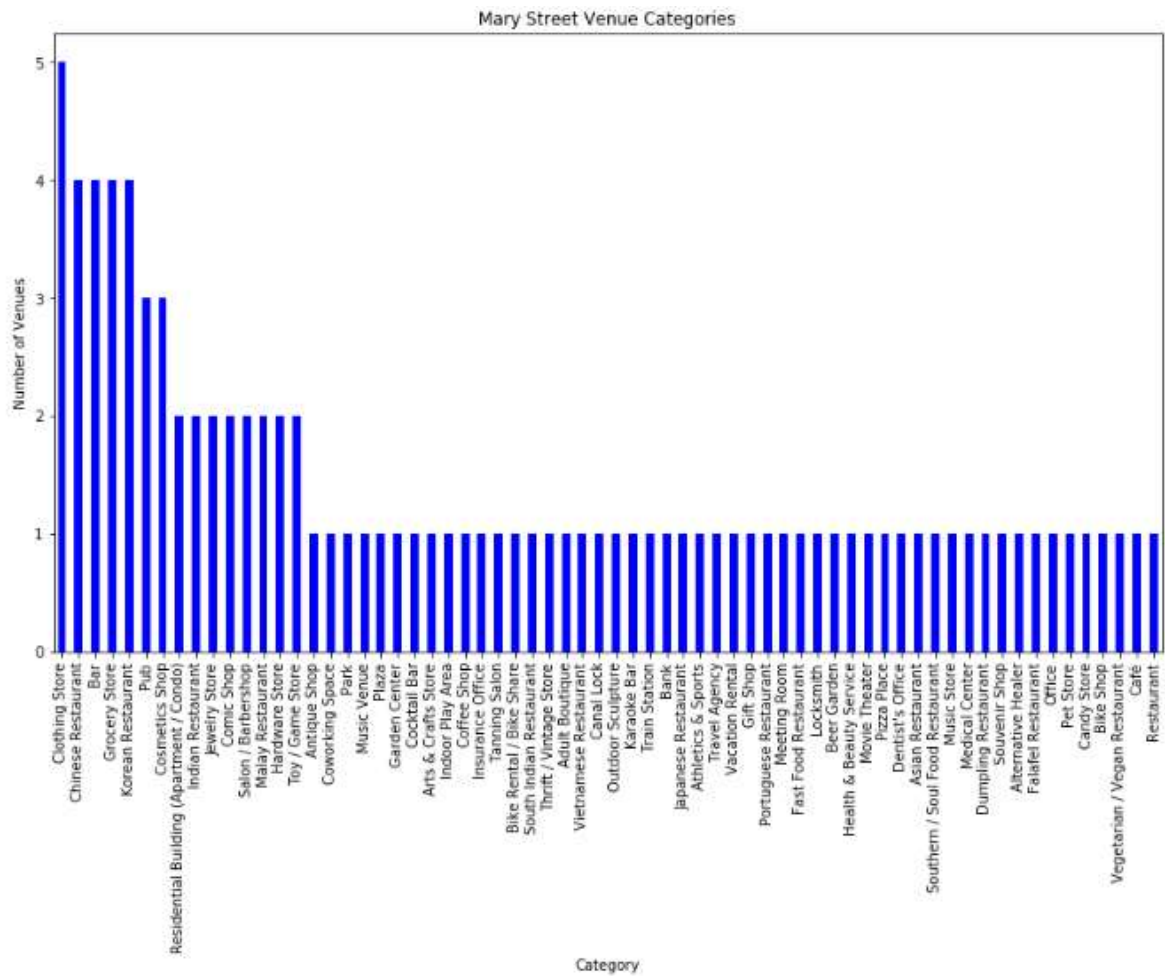|	name	categories	address	distance	lat	lng	id
0	Umi Falafel	Falafel Restaurant	4 Mary Street	10	53.348507	-6.268187	5cb5be410a08ab002c5e0650
1	Madina Desi Curry Co	Indian Restaurant	60 Mary St	5	53.348565	-6.268151	4b76c753f964a5208b5e2ee3
2	The Church CafÃ¤Â© Bar, Restaurant, Club and T...	None	Jervis Street	94	53.348650	-6.266651	500e6aefe4b0f6032ec15a03
3	Madina	Indian Restaurant	60 Mary St, North City	8	53.348487	-6.268088	4d8e42a5788c5481aef534fd
4	Carroll's Irish Gifts	Souvenir Shop	NaN	21	53.348601	-6.268389	5757f901498efe7dbe772979
5	Quick Pizza & Peri Peri Chicken	Pizza Place	6 Mary Street	20	53.348405	-6.267912	5627764f498e1e14fbc37208
6	Rambler's Way	Clothing Store	NaN	21	53.348634	-6.267756	4cde7cbb94c3b60c149965ea
7	Jim Larkin Statue	Outdoor Sculpture	O'Connell Street Lower	545	53.349031	-6.259894	4cb96d02035d236a7fc9d34e
8	The Coffee Bean	Coffee Shop	64 Mary St	27	53.348518	-6.268468	4d232806f7a9a143ccbc459f
9	Mr Middleton Garden Shop	Garden Center	NaN	9	53.348639	-6.268005	5b646855e07550002c2fb539
10	Erotica Adult Cinema	Movie Theater	NaN	32	53.348816	-6.268325	594d9dea6eda024e0a07d2c6

Figure 16 Mary Street venues dataframe head & Venue Categories bar chart

Sir John Rogerson's Quay Venues

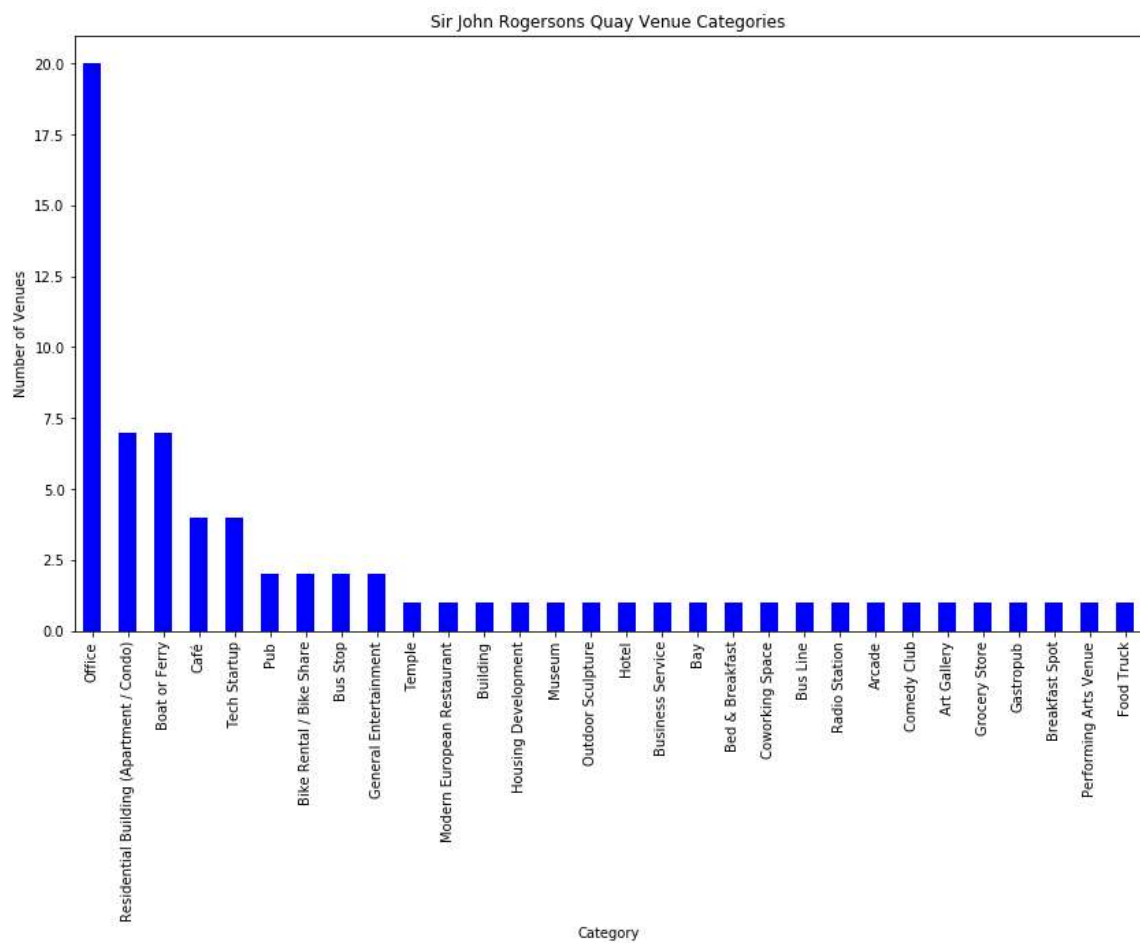|	name	categories	address	distance	lat	lng	id
0	Matheson	Office	70 Sir John Rogerson's Quay	69	53.345287	-6.233475	4d77d253a7e6b1f74e9a2bdf
1	ARA Libertad	Boat or Ferry	NaN	88	53.345954	-6.235543	5dbd77935dec290008c47e3b
2	FMB	Office	Sir John Rogerson's Quay 56	66	53.345633	-6.235299	4f216cc7e4b0b5801b90a9e5
3	MOP Solicitors	None	John Rogersons Quay	34	53.345636	-6.234818	4b1fe4c3f964a5205f2a24e3
4	Accenture The Dock	Office	7 Hanover Quay, Grand Canal Dock	183	53.344044	-6.233819	57f3965f498eb5093fe5eddd
5	Café Sora	Café	NaN	54	53.345438	-6.233580	4bed253e9868a593b1f35c46
6	State Street Bank	Building	78 Sir John Rogerson's Quay	76	53.345536	-6.233168	517a5f2c498ea1b6fc610f50
7	Indeed	Office	Sir John Rogerson's Quay 82	188	53.345392	-6.231499	5c6d0e7983e380002b277488
8	Nave Vespucci	Boat or Ferry	NaN	38	53.345947	-6.234637	5038ea79e4b0b68ee4526b51
9	Tripadvisor	Tech Startup	NaN	112	53.345297	-6.235870	5523172c498ef9a7f7194907
10	Spaces - Dublin, Spaces South Docklands	Business Service	77 Sir John Rogerson's Quay, Block C	59	53.345800	-6.233430	5d1639de3221cb0023ae1164

Figure 17 Sir John Rogerson's Quay venues dataframe head & Venue Categories bar chart

Rathmines Venues

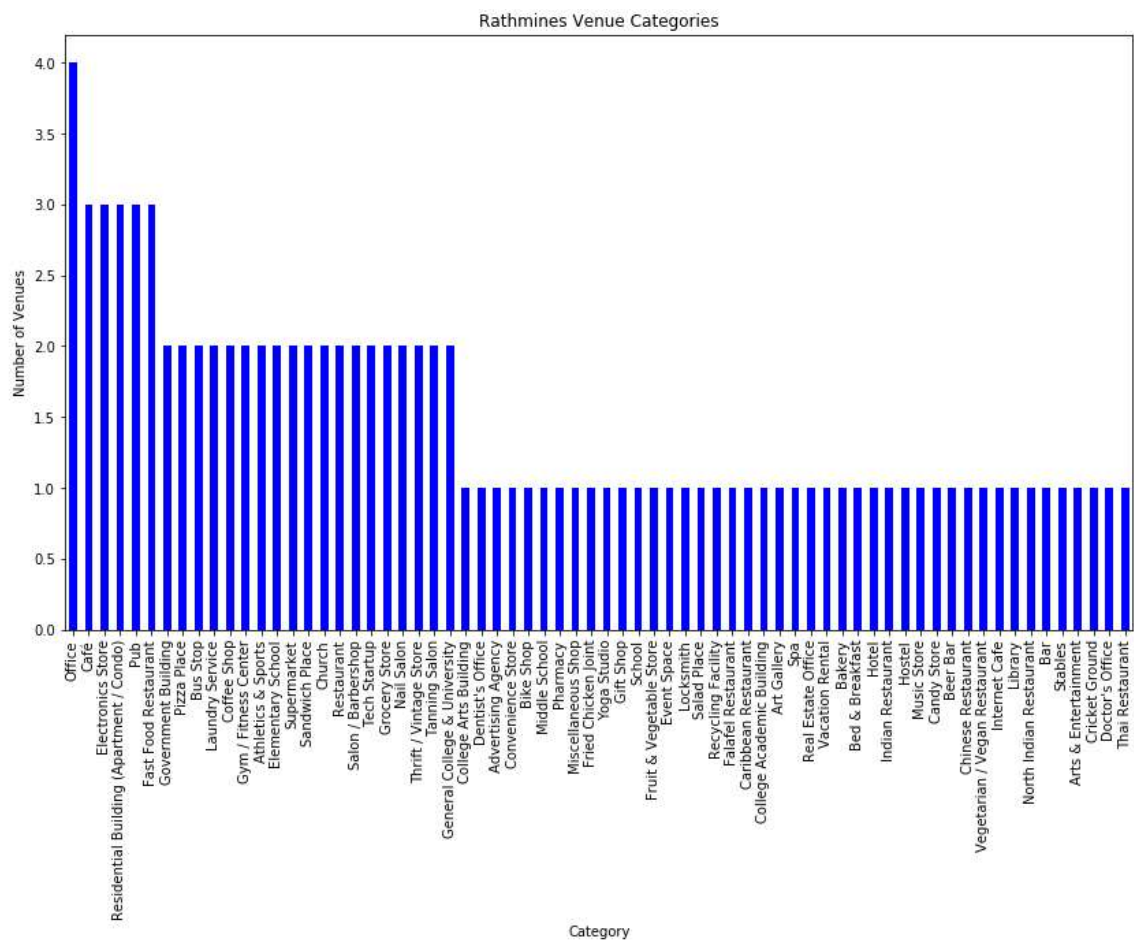|	name	categories	address	distance	lat	lng	id
0	Hillbilly's	Fast Food Restaurant	NaN	7	53.326484	-6.264952	5c7be3b0b9a5a8002cf2801d
1	Uno	Pizza Place	Rathmines	9	53.326540	-6.264989	5d3ca8dae5486f0008013e87
2	Oriental Emporium	Grocery Store	101 Lower Rathmines Rd, Rathmines	22	53.326711	-6.264961	4b7aca43f964a520e73c2fe3
3	Domino's Pizza	Pizza Place	88-90 Lower Rathmines Road	21	53.326688	-6.264708	4bd0e077046076b03df07071
4	Yoga Rathmines	Yoga Studio	St Mary's College, Lwr Rathmines Rd	181	53.327299	-6.267251	4c7be841794e224bc9ac6c28
5	Grace's Famous Fried Chicken	Fried Chicken Joint	NaN	28	53.326391	-6.265219	560bea21498e477634a094e4
6	The Orange Tree Bakery	Sandwich Place	Rathmines Rd Lwr	24	53.326302	-6.264924	53566061498e03ae386c8305
7	Blackbird	Pub	Rathmines Rd Lwr	39	53.326871	-6.264804	5391f4fd498e1d03a72c5974
8	Muscle Shop	Tanning Salon	96 Rathmines Rd Lwr	23	53.326728	-6.264857	4f2c09f2e4b0c0809d810fb6
9	Tanning Hub	Tanning Salon	NaN	35	53.326836	-6.264802	5acd07fd396de024016dd16c
10	Canal View Dental	Dentist's Office	19 Grove Road Rathmines, Dublin 6	12	53.326490	-6.265039	57e37cfc498e591ff4c2b1e5

Figure 18 Rathmines venues dataframe head & Venue Categories bar chart

Kilmainham Venues

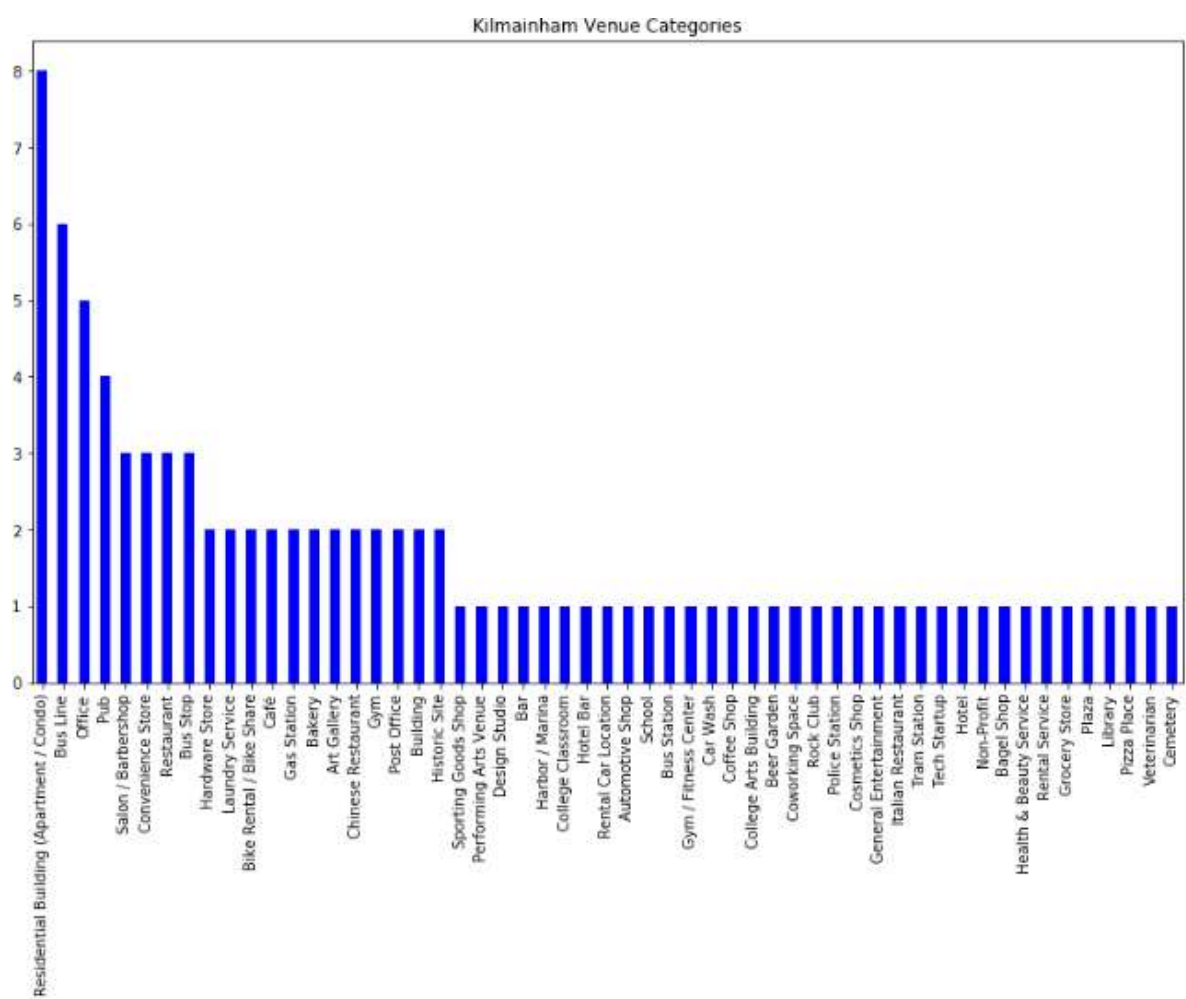|	name	categories	address	distance	lat	lng	neighborhood	id
0	Circle K	Convenience Store	South Circular Road	73	53.341541	-6.308013	NaN	5d4976d26018fe0008fa896c
1	Parcel Motel	Post Office	Topaz, S Circular Rd	68	53.341497	-6.307989	NaN	5999726accad6b5a979d6c90
2	Union8	Restaurant	740 S Circular Rd	43	53.340717	-6.307631	NaN	56800910498ec4c64e769907
3	Kilmainham Gaol	Historic Site	2 Inchicore Rd, Kilmainham	119	53.341849	-6.308478	NaN	4ade0f15f964a520117121e3
4	Four Star Pizza	Pizza Place	645 S Circular Rd, Kilmainham	48	53.340777	-6.307854	NaN	4c8a5b96770fb60cefc4d1c3
5	Hilton	Hotel	S Circular Rd, Kilmainham	154	53.342311	-6.308232	NaN	4bcf619d0ffdce72546ab2c0
6	SPAR	Convenience Store	625-627 South Circular Rd, Kilmainham	124	53.339947	-6.307652	NaN	4b698571f964a520b3a52be3
7	The Patriots Inn	Pub	760 S Circular Rd, Kilmainham	84	53.341725	-6.307832	Kilmainham	4be485b8910020a189d5d114
8	Eurospar	Convenience Store	South Circular Road	232	53.342845	-6.309064	NaN	4ef8b5ea93ad7cf2eb790a2a
9	Topaz	Gas Station	S Circular Rd, Kilmainham	48	53.341271	-6.307902	NaN	4bc5b8d06a3e9c74a42ef648
10	Lady's Lane	Beer Garden	NaN	55	53.341065	-6.306446	NaN	4e0a29e47d8b2a01806d79dc

Figure 19 Kilmainham venues dataframe head & Venue Categories bar chart

A similar analysis of venues was carried out for the 3 Cork clusters of Cork City, Douglas and Blarney,

Cork City Venues

	name	categories	address	distance	lat	lng	id
0	Butlers Chocolate Café	Coffee Shop	30 Oliver Plunkett St	9	51.897950	-8.470719	4b76ca67f964a520555f2ee3
1	General Post Office (GPO)	Post Office	Oliver Plunkett St	13	51.897997	-8.470414	4c3dc1d015cb1b8d7b547cdc
2	O'Briens Sandwich Bar	Sandwich Place	Winthrop St	16	51.898078	-8.470602	4c18f3e1fe5a76b0f5c90215
3	Vodafone	Mobile Phone Shop	109 Oliver Plunkett St	13	51.898029	-8.470478	4bb468950cbcef3b00f2582a
4	Hennessys Hair Suppies	Cosmetics Shop	NaN	72	51.897962	-8.471635	4f4500e2e4b0f94a3639f927
5	The Long Valley	Pub	10 Winthrop St.	28	51.898170	-8.470457	4ba67a29f964a520745639e3
6	Hibernian Bar (Hi B)	Pub	108 Oliver Plunkett St	10	51.898004	-8.470491	4c02b5ed9a7920a10fd9ce79
7	Fast Al's	Pizza Place	Pembroke St	24	51.897897	-8.470222	4bdf57a46198c9b68ce016ff
8	Leonidas	Chocolate Shop	Oliver Plunket St	14	51.898054	-8.470607	4c3dc1694bc9a5938d66d471
9	Penneys	Clothing Store	27-30 Saint Patrick's Street	92	51.898470	-8.471610	4b51dee0f964a520de5827e3
10	Brown Thomas	Department Store	18-21 St Patrick's St	119	51.898997	-8.470758	4b1a3d1ef964a52057e823e3

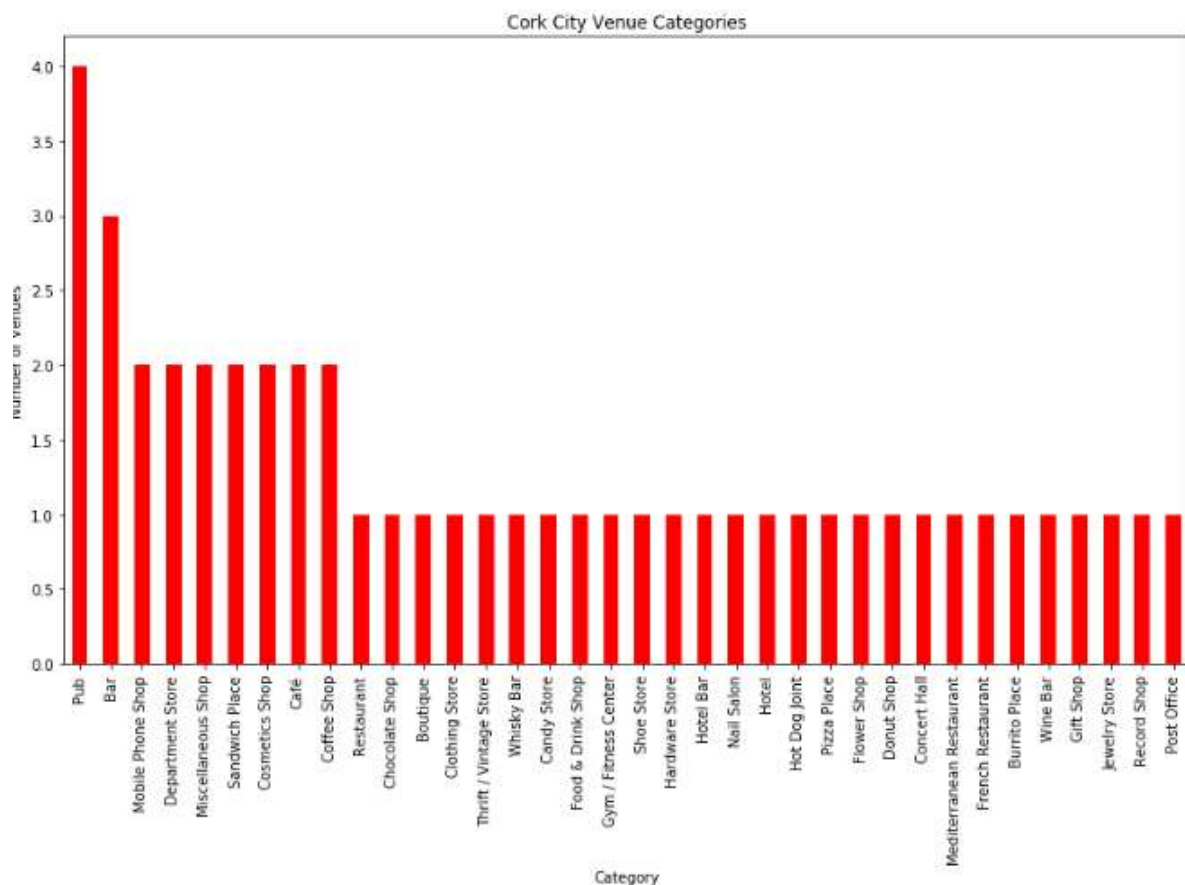Figure 20 Cork City venues dataframe head & Venue Categories bar chart

Douglas Venues

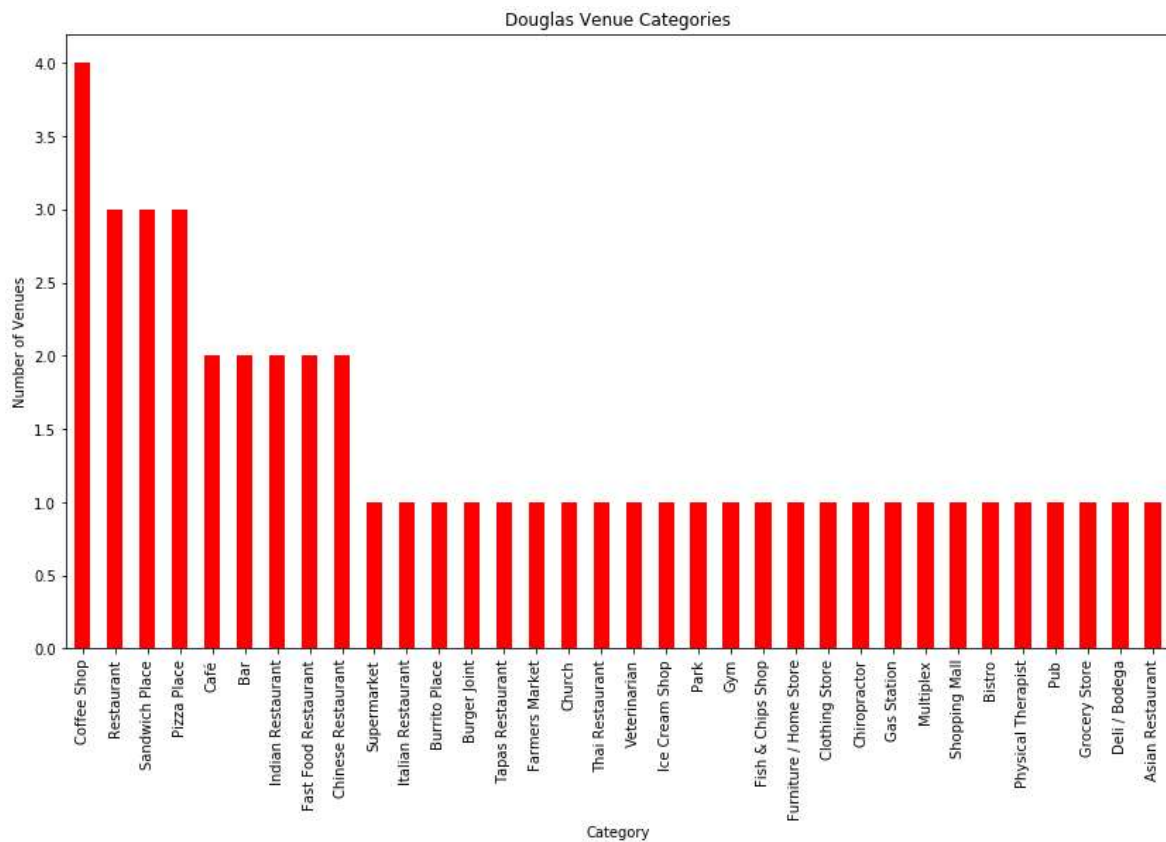|	name	categories	address	distance	lat	lng	id
0	KC & Son & Sons	Burger Joint	Douglas Village	27	51.877631	-8.436373	4b5b421ff964a52010ef28e3
1	Subway	Sandwich Place	Church Rd, Douglas	13	51.877363	-8.436019	52f6549b498e22bc130bd821
2	Barrys of Douglas	Bar	Douglas East	36	51.877152	-8.436135	4b5709b3f964a520e42328e3
3	Subway	Sandwich Place	3 Main Street, Douglas	9	51.877413	-8.435980	5e110d8a2810f5000807f957
4	Palmento	Pizza Place	NaN	40	51.877218	-8.436470	54b18884498e9899feebdf8a
5	o driscolls bar	Bar	NaN	155	51.876614	-8.437841	4b8981acf964a520083d32e3
6	Douglas Village Shopping Centre	Shopping Mall	Douglas	148	51.877527	-8.438221	4cf7a7ddc28df04d0366d115
7	Bullys Restaurant	Restaurant	7 Douglas Village	31	51.877201	-8.436005	4b93a33ff964a520294b34e3
8	Rose Garden Chinese Restaurant	Chinese Restaurant	NaN	22	51.877373	-8.436347	5030f020e4b04de6f45235d9
9	Topaz	Gas Station	Douglas Court Shopping Centre	67	51.878023	-8.436482	4c16982574fb20a1f2585012
10	East Village	Restaurant	East Village, Douglas	143	51.877766	-8.434025	4b51b0b1f964a520b35227e3

Figure 21 Douglas venues dataframe head & Venue Categories bar chart

Blarney Venues

	name	categories	address	distance	lat	lng	id
0	Blarney Castle	Castle	Caisleán na Blarnan	250	51.931415	-8.568518	4bbef73182a2ef3b9d0d2cd2
1	Christy's	Bar	Blarney Woollen Mills Hotel	54	51.933184	-8.565923	4c94c11572dd224b26aa9c91
2	Blarney Woollen Mills	Clothing Store	Millstream Row	71	51.933135	-8.565694	4b5c7aa1f964a520d83129e3
3	Catholic Church of the Immaculate Conception (...	Church	Blarney	2226	51.948530	-8.545540	4f2d7084e4b0dbffdc3c0f7e
4	Muskerry Arms	Pub	The Square	74	51.933125	-8.567697	4be14096a7380f479a8d19b0
5	Dentist	Dentist's Office	blarney	151	51.932855	-8.568727	51fb6880498ec0752d4dfc71
6	Blarney Castle Hotel	Hotel	The Square, Blarney Village	109	51.932429	-8.567205	4cd5823f886cb60c0e5e8489
7	Centra	Grocery Store	NaN	94	51.933083	-8.567974	5b01884c295513002c37f376
8	The Old Blarney Post Office	Café	The Square	166	51.932189	-8.568181	57260d6e498efe7269fef5f9
9	The Mill Restaurant	Restaurant	Blarney Woollen Mills Hotel	96	51.933116	-8.565317	4f6b2effe4b0f7fc5483a17b
10	Blarney Square	Park	NaN	144	51.932462	-8.568209	5a3fe217535d6f23fc98841f

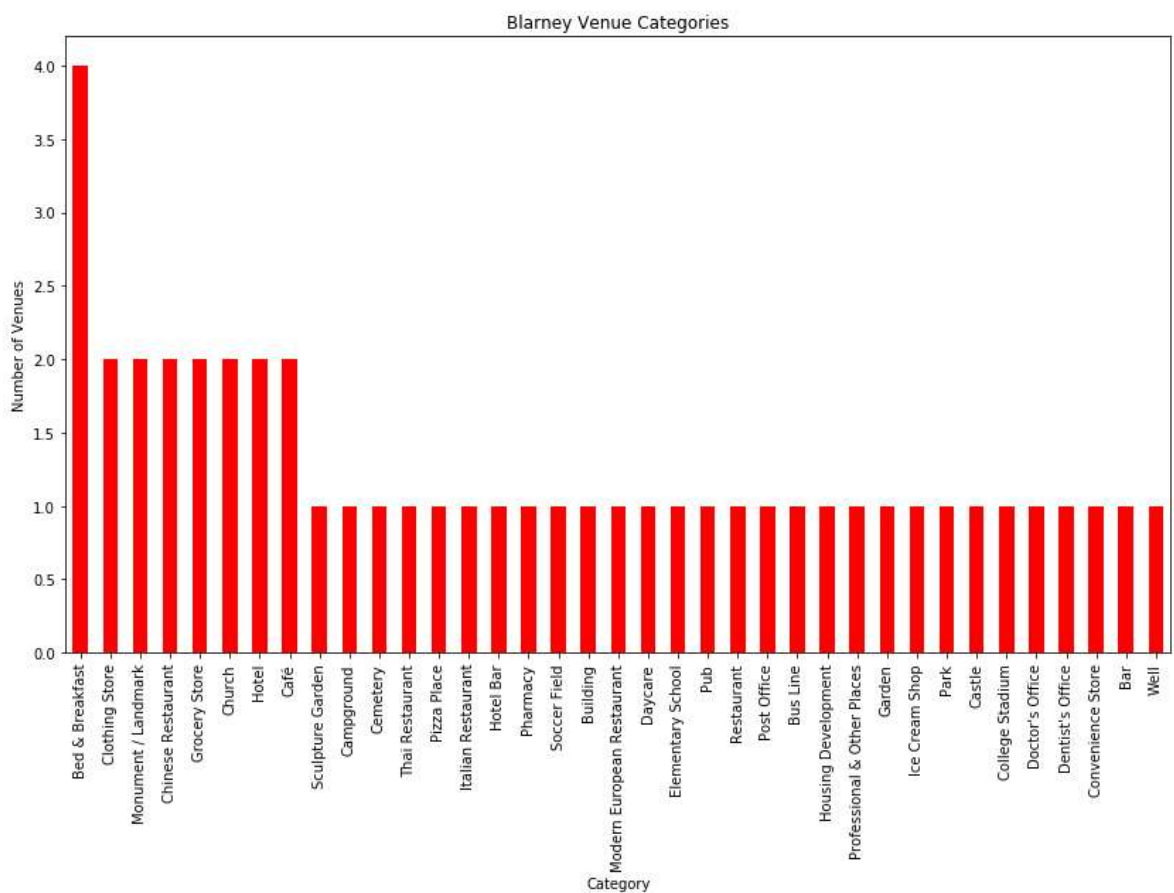*Figure 22 Blarney venues dataframe head & Venue Categories bar chart*

4. Results section.

Analysis of homelessness data

The key results from this analysis are:

- According to the official Irish Government figures here are currently 6,696 homeless people in the Republic of Ireland (4,534 in Dublin City and 447 in Cork City)
- The level of homelessness in the Republic of Ireland is about 0.14% (6,996 homeless in a population of 4.8 million people.
- The level of homelessness in Ireland has increased by 134% in the years 2014-2019 (from 2,858 to 6,696 people)
- The level of homeless in Dublin is about 0.25% (4,534 homeless in a population of 1.8 million people).
- The level of homelessness in Dublin has increased by 143% in the years 2014-2019 (from 1,868 to 4,534 people)
- The level of homelessness in Cork is about 0.21% (447 people in a population of 210,000 people)
- The level of homelessness in Cork has increased by 130% in the years 2014-2019 (from 194 to 447 people)

Analysis of new dwelling completions data

The key results from this analysis are:

- Ireland experienced a property bubble in the early 2000's.
- The property bubble began with 49,812 new dwelling completions in 2000 and peaking in 2005/2006 with 85,957 new dwelling completions in 2005 and 88,419 new dwelling completions in 2006.
- After the global economic crash of 2008/2009, Ireland experience a property crash and the number of new dwellings completed fell sharply.
- This crash reached a low of 4,575 dwellings built in 2013 (the year before homeless figures began to rise significantly)
- At the low point of 2013, the number of new dwellings built was 9.2% of the number of new dwellings completed in 2000 (49,812) and only 5.2% of the new dwellings completed at the peak in 2006 (88,419).
- From 2014 the level of new dwelling completions began to rise slowly.
- In 2019 the number of new dwellings completed reached 19,685. This is still only 39.5% of the 2000 new dwelling builds and short of the 25,000 new dwelling completions predicted by the Irish government as being required to keep up with the demand.

Analysis of Airbnb Listings Data

Dublin Airbnb Listings

The key results from this analysis are:

- There are 9,437 Airbnb property listings in Dublin.
- Of these properties only 2,912 would possibly be suitable for homeless people as they are full properties (i.e. entire house or apartment) rather than a room in someone's home.
- The majority of these properties (2,397, 82%) are located in Dublin City neighbourhood.
- The median annual earnings for a property in this neighbourhood is €13,400 if the property is fully occupied on the days listed as being available.
- Only 1,450 of the 2,912 properties (49.7%) appear to be complying with the new legislation of a no more than 90 days in rent pressure zones. 1,462 properties are available >90 days. 867 properties are available >180days. 53 properties are available 365 days.

Cork Airbnb Listings

- There are 539 Airbnb property listings in Dublin.
- Of these properties only 178 would possibly be suitable for homeless people as they are full properties (i.e. entire house or apartment) rather than a room in someone's home.
- Unlike in Dublin there is less of a concentration of listings in one neighbourhood. A slight majority of the properties are located in the Cork City South Central neighbourhood.
- The median annual earnings for a property in this neighbourhood is €21,003 if the property is fully occupied on the days listed as being available. The reason that the possible earnings are larger than in Dublin is because the properties are listed with greater number of available days per year rather than being more expensive per day.
- Only 1,450 of the178 properties (49.7%) appear to be complying with the new legislation of a no more than 90 days in rent pressure zones. 1,462 properties are available >90 days. 867 properties are available >180days. No properties are available 365 days.

<u>Analysis of venues near Airbnb clusters</u>

The venues located near the Airbnb clusters in Dublin and Cork are summarized below:

<u>Dublin Clusters</u>

Neighbourhood	Top 5 categories of Venue	Commentary
Mary Street	(1) Clothing Store (2) Chinese Restaurant (3) Bar (4) Grocery Store (5) Korean Restaurant	Mary Street is located on Dublin's Northside. At Liffey Street, the street becomes Henry Street. Henry Street and Mary Street are often considered as one. This street is one of the two main shopping streets in Dublin
Sir John Rogerson's Quay	(1) Office (2) Boat/Ferry (3) Residential (Apartment/Condo) (4) Café (5) Tech Start-Up	As of the early 21st century, the previously functional maritime buildings and features of Sir John Rogerson's Quay have been redeveloped for heritage tourism, and newer office buildings built on the quay. Many global technology and finance companies have offices located in this area.
Rathmines	(1) Electronics Store (2) Fast Food Restaurant (3) Café (4) Residential (Apartment/Condo) (5) Pizza Place	Rathmines has thriving commercial and civil activity and is well known across Ireland as part of a traditional "flatland" - providing rented accommodation to newly arrived junior civil servants and third level students coming from outside the city.
Kilmainham	(1) Residential (Apartment/Condo) (2) Bus Line (3) Office (4) Pub (5) Salon / Barber Shop	Up-and-coming Kilmainham is a laid-back neighbourhood with trendy eating spots, traditional pubs and several popular cultural attractions. These include the Irish Museum of Modern Art, in a grand 17th-century hospital, and the Victorian prison museum, at Kilmainham Gaol.

The Airbnb clusters in Dublin may be popular for Airbnb users due to proximity to shopping districts (e.g. Mary Street), or business travellers/workers who may be working on a short-term contract basis for Technology or Finance companies (e.g. Sir John Rogerson's Quay). Those seeking a more "laid-back" or "hipster" vibe with some cultural spots may be choosing Kilmainham. The locations in Rathmines could possibly be chosen by students/workers who have moved to Dublin and are looking for a base in the short term whilst seeking a longer-

term rental property. Some of these locations may not be suitable for housing homeless people.

Cork Clusters

Neighbourhood	Top 5 categories of Venue	Commentary
Cork City	(1) Pub (2) Bar (3) Mobile Phone Shop (4) Department Store (5) Miscellaneous Shop	Cork's compact city centre is a busy shopping district with mainstream boutiques and the 18th-century indoor English Market for organic cheese and meat. Dining options include upscale Atlantic seafood bistros and long-standing pubs that serve classic Irish lamb stew and host live folk music sessions.
Douglas	(1) Coffee Shop (2) Restaurant (3) Sandwich Place (4) Pizza Place (5) Cafe	The sprawling suburb of Douglas is centred on a compact village with mainstream shopping malls, eclectic eateries, and pubs serving traditional Sunday lunches of roast meats.
Blarney	(1) Bed & Breakfast (2) Clothing Store (3) Monument/Landmark (4) Chinese Restaurants (5) Grocery Store	Blarney is a village just outside the city of Cork, in southwestern Ireland. Its 15th-century Blarney Castle is home to the legendary Blarney Stone, said to give the "gift of the gab" (i.e. eloquence) to those who kiss it. Extensive parkland surrounding the castle features a network of trails, themed gardens and the large, turreted Blarney House. A 19th-century building in the village centre houses the former Blarney Woollen Mills.

The Airbnb clusters in Cork may be popular for Airbnb users due to proximity to pubs and shopping districts (e.g. Cork), or those seeking a village feel with lots of restaurants which is a little bit further out from the city centre (e.g. Douglas). Th e cluster around Blarney seems to be firmly focused on the tourist trade with bed & breakfast, shops and restaurants aimed at tourists visiting Blarney castle. Again, some of these locations may not be suitable for housing homeless people.

5. Discussion

Based on the analysis carried out, the cause of increased homelessness in Ireland appears to be primarily driven by a gap between supply of and demand for new dwellings. This was caused by a severe slow-down in new dwelling completions after the global economic downturn in 2008/2009. The lowest point was 4,575 new dwellings completed in 2013. The number of new builds started to slowly from 2013 onwards. In 2019 the number of new dwellings reached 19,685 (much lower than the peaks seen during the Irish property boon of the early 2000's).

Despite this acceleration in new dwelling completions, the supply has not kept up with demand and the number of homeless has continued to rise. In December 2019, the Irish Prime Minister Leo Varadkar pledged to build 25,000 new homes in 2020, which seems to indicate that this is the desired target number required to keep up with demand https://www.irishexaminer.com/breakingnews/ireland/leo-varadkar-pledges-25000-homes-to-be-built-in-2020-972044.html

Airbnb listings seems to be clustered around certain neighbourhoods in both Dublin and Cork. These neighbourhoods can be popular for various reasons such as shopping, entertainment, cultural hotspots, tourist spots and even proximity to offices/work locations.

Based on the analysis carried out, Airbnb listings may be a small factor in the number of dwellings available, however they are not the major cause of homelessness. If we examine the 2019 Dublin Airbnb listings, there are 1,462 full properties (i.e. not individual rooms in homes) that are available more than 90 days, 867 properties that are available for more than half of the year (180 days) and only 53 properties available all year round (365 days). Even if we assumed all of the properties that exceed the rent pressure zone cap of 90 days (1,462) could be reassigned to housing the homeless and also assume that these properties are suitable for it is unlikely that this would be sufficient to home the 4,534 individual homeless people in Dublin.

If we take a look at the number of homeless families in Dublin, rather than just individuals, the Irish government figures state that in 2019 there were 1,256 families that were homeless. If we add up the numbers of individuals in these family units it equates to 4,604 of the 4,534 number of homeless people in Dublin (1,822 adults and 2,782 dependents). As only 53 properties are available all year round and only 867 are

available for half of the year this means that most properties are not available for long term rental to house homeless people. If the cap of 90 days was strictly enforced, then 1,462 properties would be made available which could house all homeless families (assuming all of these properties are suitable for housing families on a long-term rental basis which is unlikely). However, it is likely that many landlords who currently rent on Airbnb for >90days would either reduce their letting to 90 days per year or sell the property as it would not be financially viable for them to rent to homeless families. It is clear that although the 90-day cap in rent pressure zones might make a very slight improvement in homeless numbers, it is not the solution to resolving the supply in new dwellings problem.

Nonetheless it should be noted that there appears to be a significant number of listings which do not comply with the new legislation capping short term rental properties to no more than 90 days in rent pressure zones. This may because the 2019 dataset used preceded the implementation of the legislation which occurred in mid-2019. There is some potential that enforcement and compliance with the new legislation could at least in a small way alleviate (although not resolve) the current homelessness problem in Ireland.

6. Conclusion

The cause of increased homelessness in Ireland is driven by a gap between supply of and demand for new dwellings. This was caused by a severe slow-down in new dwelling completions after the global economic downturn in 2008 with a low point in 2013. Homelessness in Ireland began to increase significantly from 2014 onwards due to a lack of supply of dwellings. As of 2019, the supply has not kept up with demand and the number of homeless has continued to rise. In December 2019, the Irish Prime Minister Leo Varadkar pledged to build 25,000 new homes in 2020, which seems to indicate that this is the desired target number required to keep up with demand

Based on the analysis carried out, Airbnb listings may have a very small role to play in the number of dwellings available, however they are not the major factor as most Airbnb properties are not suitable or available for long term rentals.

However, it should be noted that the cap of 90 days introduced by the Irish Government in mid-2019 was strictly enforced, then it is likely that some small number additional properties would be made available to house homeless families. It would not fix the

problem. Nonetheless, there appears to be a significant number of listings which do not comply with the new legislation capping short term rental properties to no more than 90 days in rent pressure zones. This may because the dataset used preceded the implementation of the legislation. Further analysis of the revised 2020 datasets should be carried out to assess Airbnb compliance with the legislation, number of new dwellings and impact on the numbers of homeless people.