Index

Importing the Libraries

In [1]:
```
import pandas as pd
from scipy.stats import skew
import numpy as np
import scipy.stats
import pylab
import matplotlib.pyplot as plt
import seaborn as sns
from scipy import stats
from os import listdir
import os
from os.path import isfile, join
import pgeocode
import datetime
from pandas.plotting import autocorrelation_plot
from statsmodels.tsa.stattools import adfuller
import statsmodels.graphics.tsaplots as sgt
from fbprophet import Prophet
from statsmodels.tsa.seasonal import seasonal_decompose
%matplotlib inline
sns.set()
pd.set_option('display.float_format', lambda x: '%.3f' % x)
```

Data Preparation/Extraction

In [2]:
```
df=pd.DataFrame()
```

In [3]:
```
d = './All Data 0808/'
subdirs = [os.path.join(d, o) for o in os.listdir(d) if os.path.isdir(os.path.join(d,o))]

for dir_ in subdirs:
    x=[f for f in listdir(dir_) if isfile(join(dir_, f))][1]
    final_path=dir_+'/'+x
    temp=pd.read_csv(final_path)
    df=pd.concat([df,temp])

df.to_csv('Data.csv',index=False)
df=df.reset_index().drop('index',axis=1)
df.head()
```

Out[3]:

	LoanAmount	City	State	Zip	NAICSCode	BusinessType	RaceEthnicity	Gender	Veteran	NonProfit	JobsRep
0	149978.000	PELHAM	AL	35124.000	561311.000	Limited Liability Company(LLC)	Unanswered	Unanswered	Unanswered	NaN	1
1	149900.000	BIRMINGHAM	AL	35242.000	561311.000	Corporation	Unanswered	Female Owned	Unanswered	NaN	3
2	149887.000	TRUSSVILLE	AL	35173.000	238910.000	Limited Liability Company(LLC)	Unanswered	Unanswered	Unanswered	NaN	1
3	149865.000	Trussville	AL	35173.000	621340.000	Self-Employed Individuals	Unanswered	Unanswered	Unanswered	NaN	(
4	149862.000	SPRINGVILLE	AL	35146.000	624221.000	Non-Profit Organization	Unanswered	Unanswered	Unanswered	Y	1

df=pd.read_csv('Data.csv') df=df.iloc[:100000] df=df.reset_index().drop('index',axis=1) df.head()

In [4]:
```
df.shape
```

Out[4]: (4549613, 14)

Data Processing/Cleaning

Null Values

In [5]:
```
x=pd.DataFrame(df.isnull().sum())
x=x.reset_index()
x.columns=['Column','Null Values']
x['% Of Null Values']=x['Null Values'].apply(lambda x:(x/df.shape[0])*100)
x
```

Out[5]:

	Column	Null Values	% Of Null Values
0	LoanAmount	0	0.000
1	City	186	0.004
2	State	149	0.003
3	Zip	180	0.004
4	NAICSCode	126429	2.779
5	BusinessType	3165	0.070
6	RaceEthnicity	0	0.000
7	Gender	0	0.000
8	Veteran	0	0.000
9	NonProfit	4409022	96.910
10	JobsReported	297998	6.550
11	DateApproved	0	0.000
12	Lender	0	0.000
13	CD	794	0.017

In [6]:
```
df['State'].fillna('Unknown',inplace=True)
df['City'].fillna('Unknown',inplace=True)
df['BusinessType'].fillna('Unknown',inplace=True)
df.drop(['NAICSCode','NonProfit','CD','Zip'],axis=1,inplace=True)

data=df[pd.isnull(df['JobsReported'])]
data=data.reset_index().drop('index',axis=1)
df=df[~(pd.isnull(df['JobsReported']))]

df2=pd.DataFrame(df.groupby('State')['JobsReported'].median()).reset_index()

for i in range(len(data)):
    state=data['State'][i]
    #print(state)
    val=df2[df2['State']==state]['JobsReported'].tolist()[0]
    data['JobsReported'][i]=val

df=pd.concat([df,data])
```

```
<ipython-input-6-4cfdbe59dbb5>:16: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexin
g.html#returning-a-view-versus-a-copy
  data['JobsReported'][i]=val
```

In [7]:
```
x=pd.DataFrame(df.isnull().sum())
x=x.reset_index()
x.columns=['Column','Null Values']
x['% Of Null Values']=x['Null Values'].apply(lambda x:(x/df.shape[0])*100)
x
```

Out[7]:

	Column	Null Values	% Of Null Values
0	LoanAmount	0	0.000
1	City	0	0.000
2	State	0	0.000
3	BusinessType	0	0.000
4	RaceEthnicity	0	0.000
5	Gender	0	0.000
6	Veteran	0	0.000
7	JobsReported	0	0.000
8	DateApproved	0	0.000
9	Lender	0	0.000

In [8]:
```
df=df.reset_index().drop('index',axis=1)
df['City']=df['City'].apply(lambda x:x.title())
df['DateApproved']=df['DateApproved'].apply(lambda x:datetime.datetime.strptime(x, '%m/%d/%Y'))
```

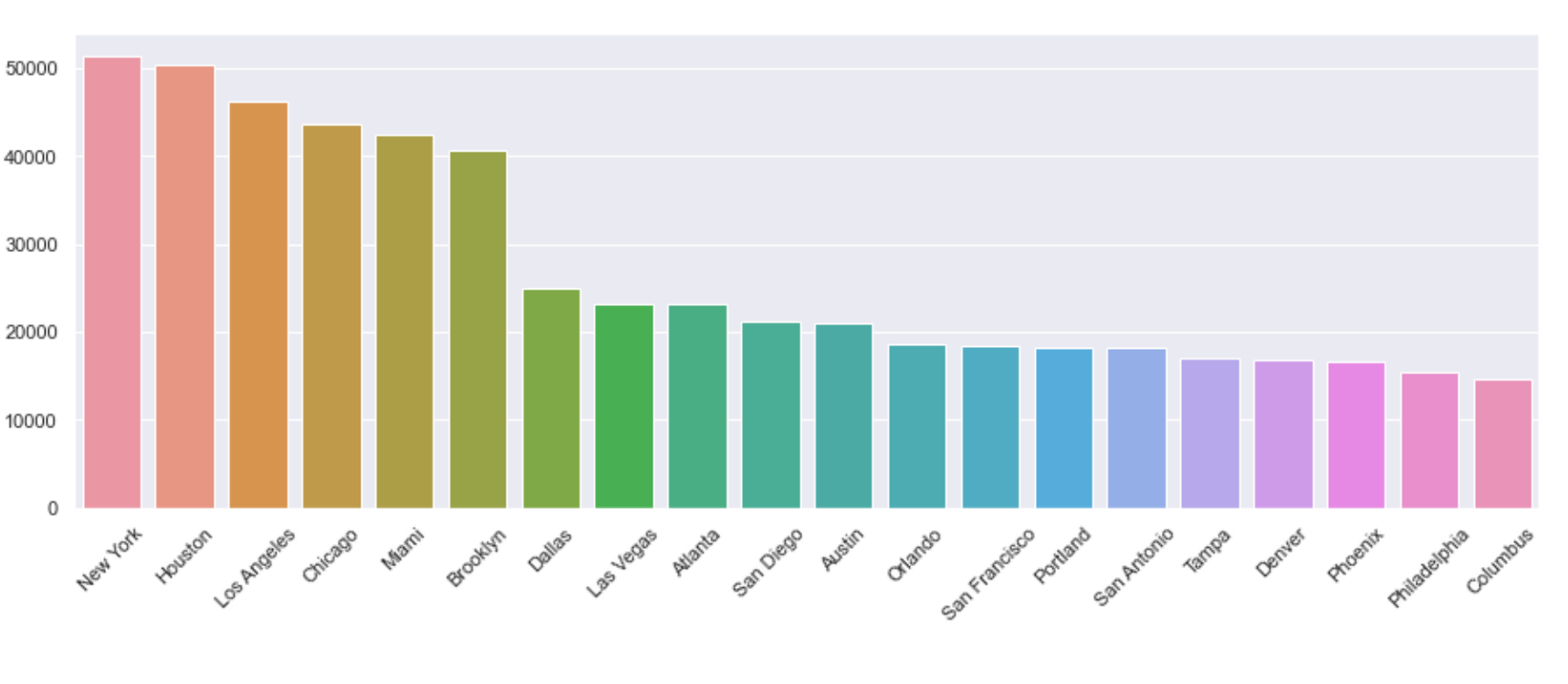
EDA

By Geography

City With Most Granted Loans (Top 20)

In [9]:
```
x=df['City'].value_counts()[:20]
plt.figure(figsize=(15,5))
sns.barplot(list(x.index),list(x.values))
plt.xticks(rotation=45)
```

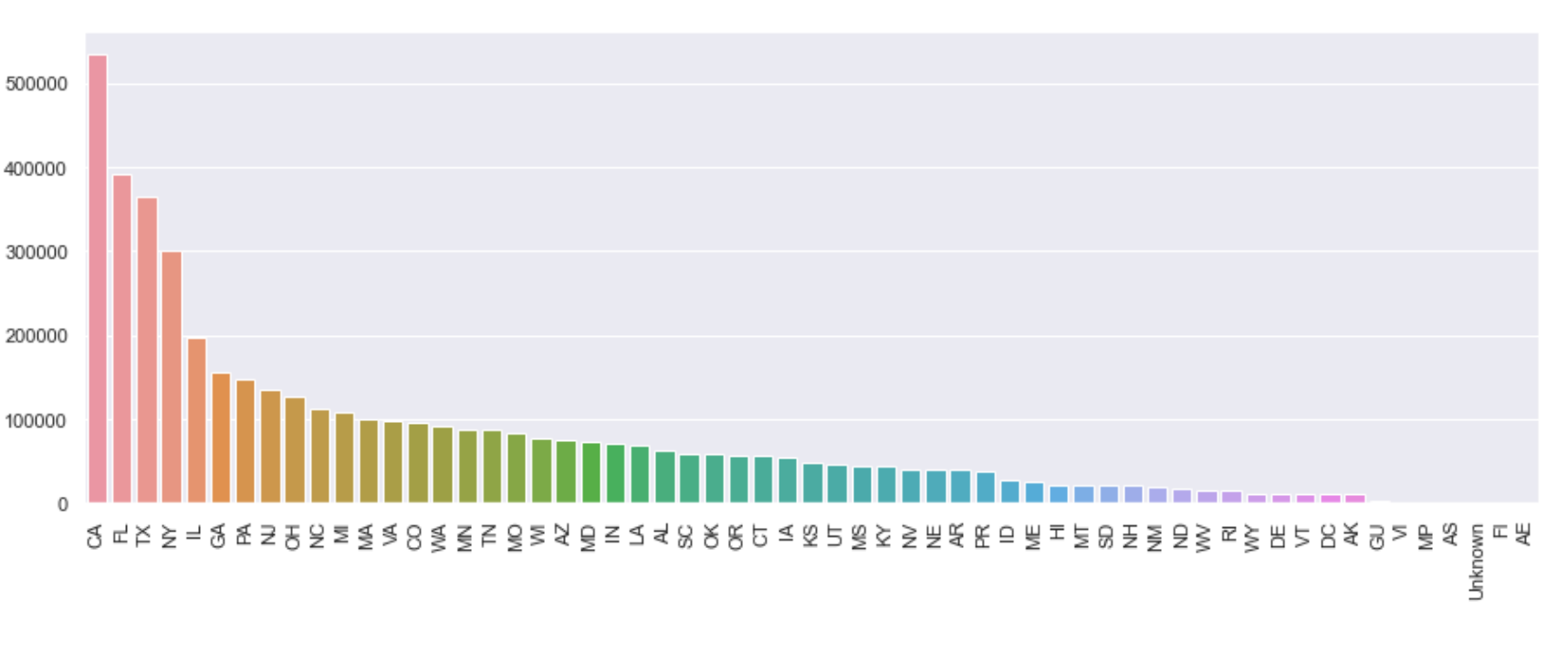
Out[9]:
```
(array([ 0,  1,  2,  3,  4,  5,  6,  7,  8,  9, 10, 11, 12, 13, 14, 15, 16,
        17, 18, 19]),
 <a list of 20 Text major ticklabel objects>)
```



State With Most Granted Loans (Top 20)

In [10]:
```
x=df['State'].value_counts()
plt.figure(figsize=(15,5))
sns.barplot(list(x.index),list(x.values))
plt.xticks(rotation=90)
```

Out[10]:
```
(array([ 0,  1,  2,  3,  4,  5,  6,  7,  8,  9, 10, 11, 12, 13, 14, 15, 16,
        17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33,
        34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50,
        51, 52, 53, 54, 55, 56, 57, 58]),
 <a list of 59 Text major ticklabel objects>)
```



City with most granted loans from each state

In [11]:
```
x=pd.DataFrame(df.groupby(['State','City'])['City'].count().sort_values(ascending=False))
x.columns=['Count']
x.head()
```

Out[11]:

State	City	Count
NY	New York	51430
TX	Houston	50038
CA	Los Angeles	46128
IL	Chicago	43702
FL	Miami	42144

City with Highest And Lowest sum of Loan Amount (Top 20)

In [12]:
```
#Highest
x1=pd.DataFrame(df.groupby('City')['LoanAmount'].sum().sort_values(ascending=False)[:20])
x1.columns=['Total Loan Amount']
x1.head()
```

Out[12]:

City	Total Loan Amount
New York	1954880999.190
Houston	1619066643.330
Los Angeles	1415215833.860
Chicago	1271834850.370
Miami	1162932132.620

In [13]:
```
#Lowest
x2=pd.DataFrame(df.groupby('City')['LoanAmount'].sum().sort_values()[:20])
x2.columns=['Total Loan Amount']
x2.head()
```

Out[13]:

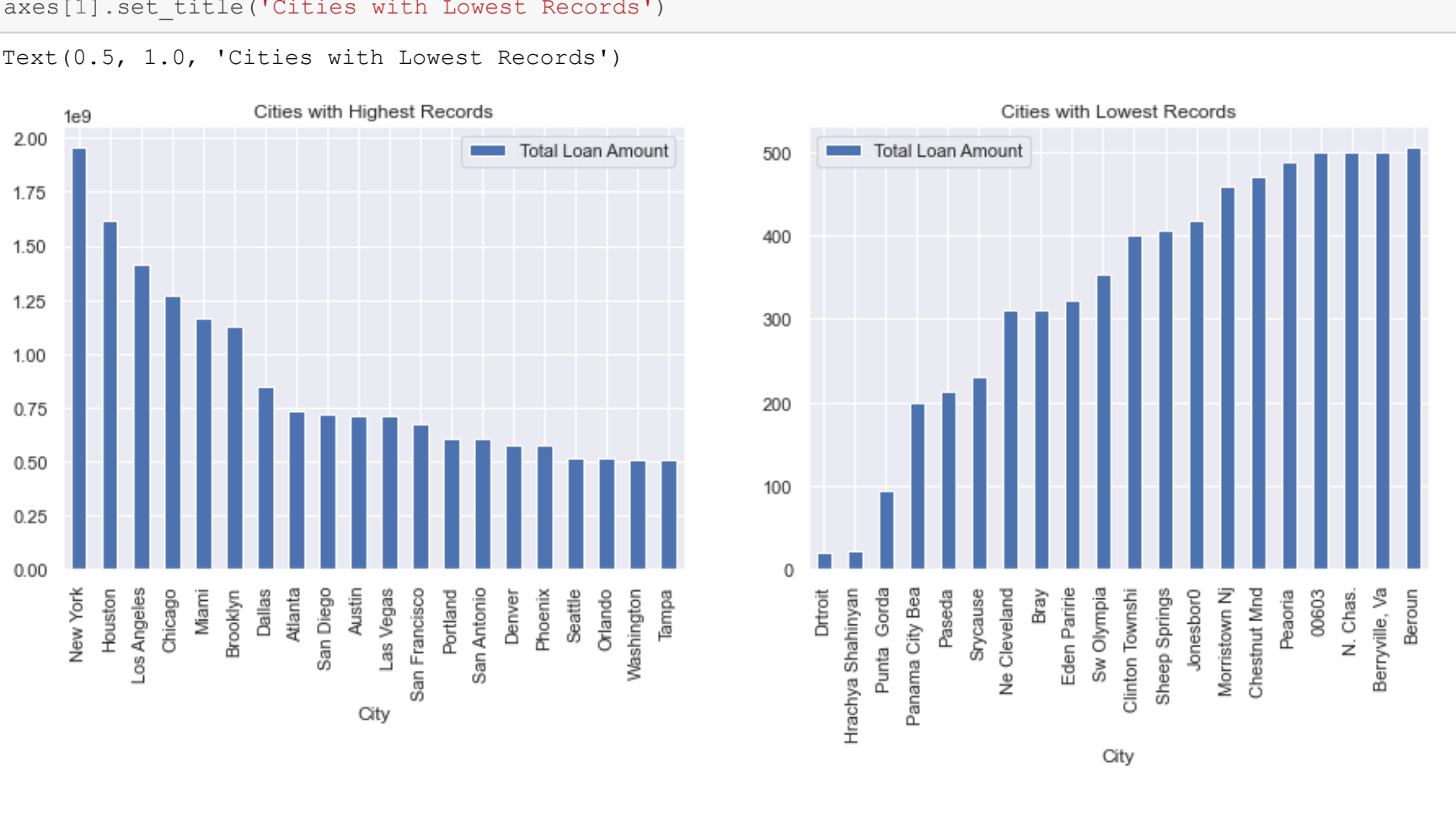
City	Total Loan Amount
Drtroit	20.000
Hrachya Shahinyan	22.000
Punta Gorda	93.320
Panama City Bea	200.000
Paseda	213.000

In [14]:
```
fig,axes=plt.subplots(nrows=1,ncols=2,figsize=(15,5))

x1.plot(kind='bar',ax=axes[0],legend=True)
x2.plot(kind='bar',ax=axes[1],legend=True)


axes[0].set_title('Cities with Highest Records')
axes[1].set_title('Cities with Lowest Records')
```

Out[14]: Text(0.5, 1.0, 'Cities with Lowest Records')



State with Highest And Lowest sum of Loan Amount (Top 20)

In [15]:
```
#Highest
x1=pd.DataFrame(df.groupby('State')['LoanAmount'].sum().sort_values(ascending=False)[:20])
x1.columns=['Total Loan Amount']
x1.head()
```

Out[15]:

State	Total Loan Amount
CA	18472898255.450
TX	11807031808.095
FL	11387232981.620
NY	9898258929.970
IL	5935479964.860

In [16]:
```
#Lowest
x2=pd.DataFrame(df.groupby('State')['LoanAmount'].sum().sort_values()[:20])
x2.columns=['Total Loan Amount']
x2.head()
```

Out[16]:

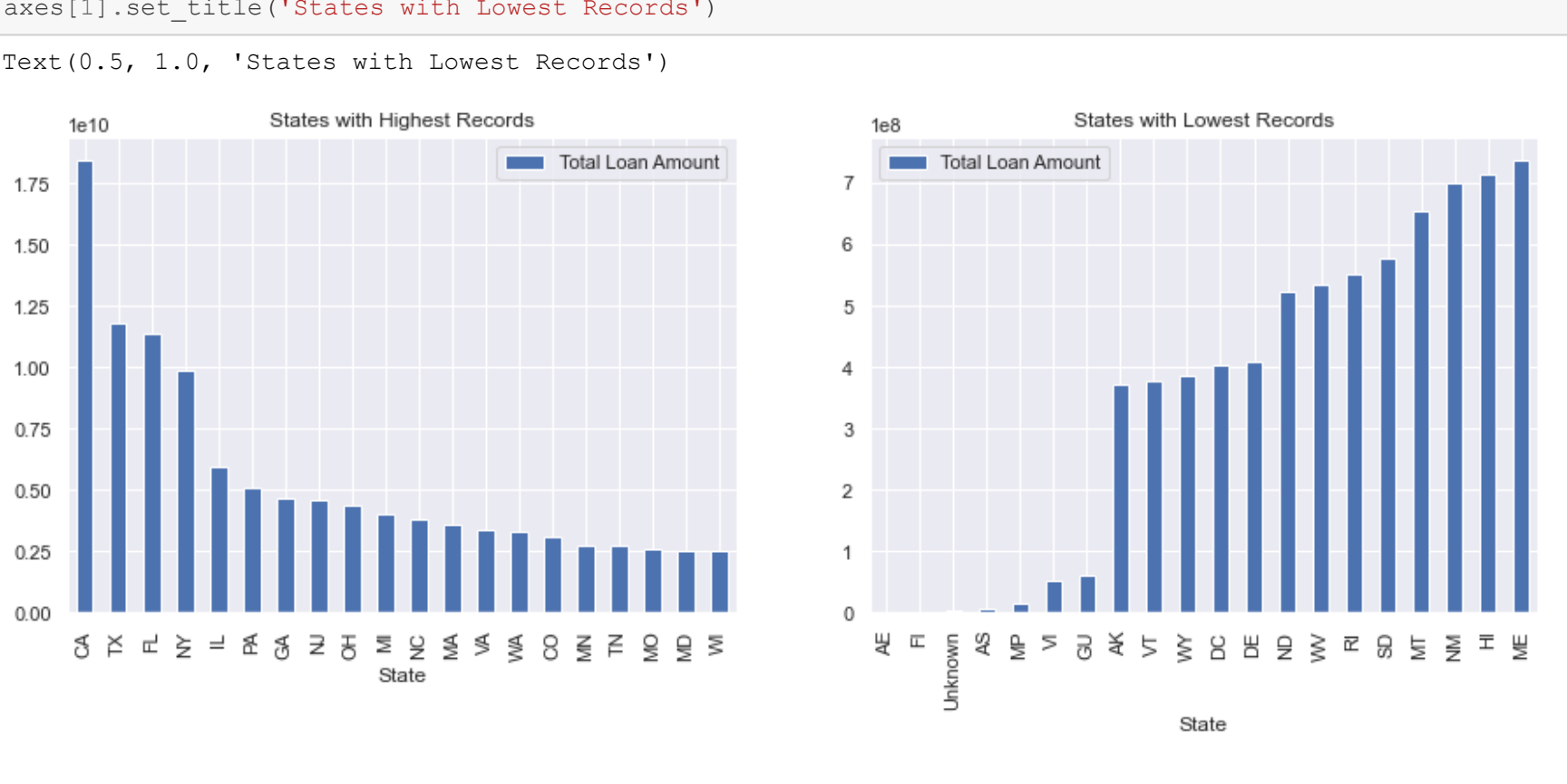
State	Total Loan Amount
AE	27400.000
FI	42100.000
Unknown	4445660.030
AS	6320884.240
MP	14630538.290

In [17]:
```
fig,axes=plt.subplots(nrows=1,ncols=2,figsize=(15,5))

x1.plot(kind='bar',ax=axes[0],legend=True)
x2.plot(kind='bar',ax=axes[1],legend=True)


axes[0].set_title('States with Highest Records')
axes[1].set_title('States with Lowest Records')
```

Out[17]: Text(0.5, 1.0, 'States with Lowest Records')

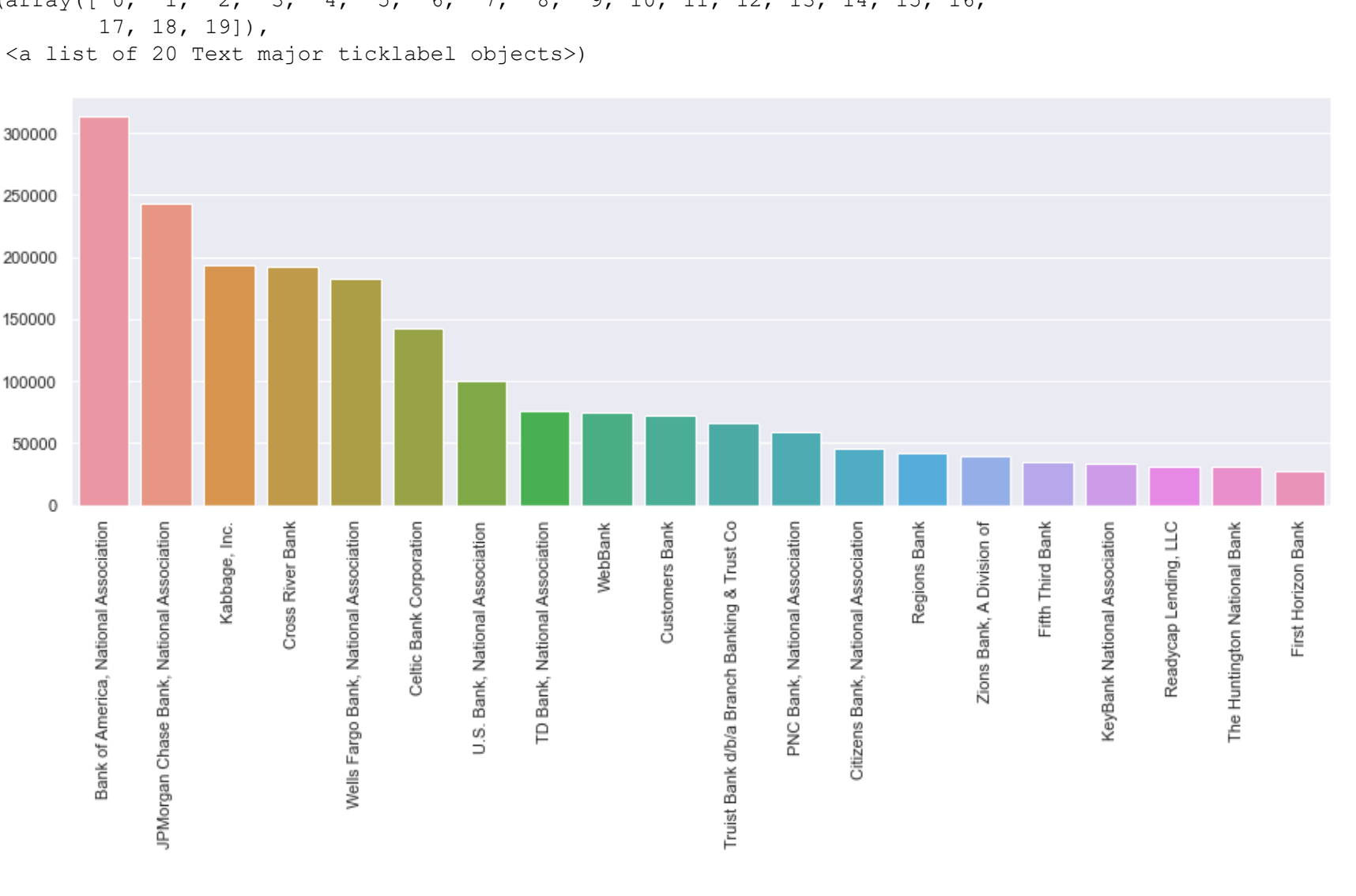


By Lender

Lender with most granted loans (Top 20)

In [18]:
```
x=df['Lender'].value_counts()[:20]
plt.figure(figsize=(15,5))
sns.barplot(x.index,x.values)
plt.xticks(rotation=90)
```

Out[18]:
```
(array([ 0,  1,  2,  3,  4,  5,  6,  7,  8,  9, 10, 11, 12, 13, 14, 15, 16,
        17, 18, 19]),
 <a list of 20 Text major ticklabel objects>)
```



Lender with highest sum and average loan

In [19]:
```
x1=df.groupby('Lender')['LoanAmount'].sum().sort_values(ascending=False)[:10]
x2=df.groupby('Lender')['LoanAmount'].mean().sort_values(ascending=False)[:10]

fig,axes=plt.subplots(nrows=1,ncols=2,figsize=(15,5))

x1.plot(kind='bar',ax=axes[0],legend=True)
x2.plot(kind='bar',ax=axes[1],legend=True)


axes[0].set_title('Lender with Highest total loan')
axes[1].set_title('Lender with Highest average loan')
```

Out[19]: Text(0.5, 1.0, 'Lender with Highest average loan')

City and State with most lenders

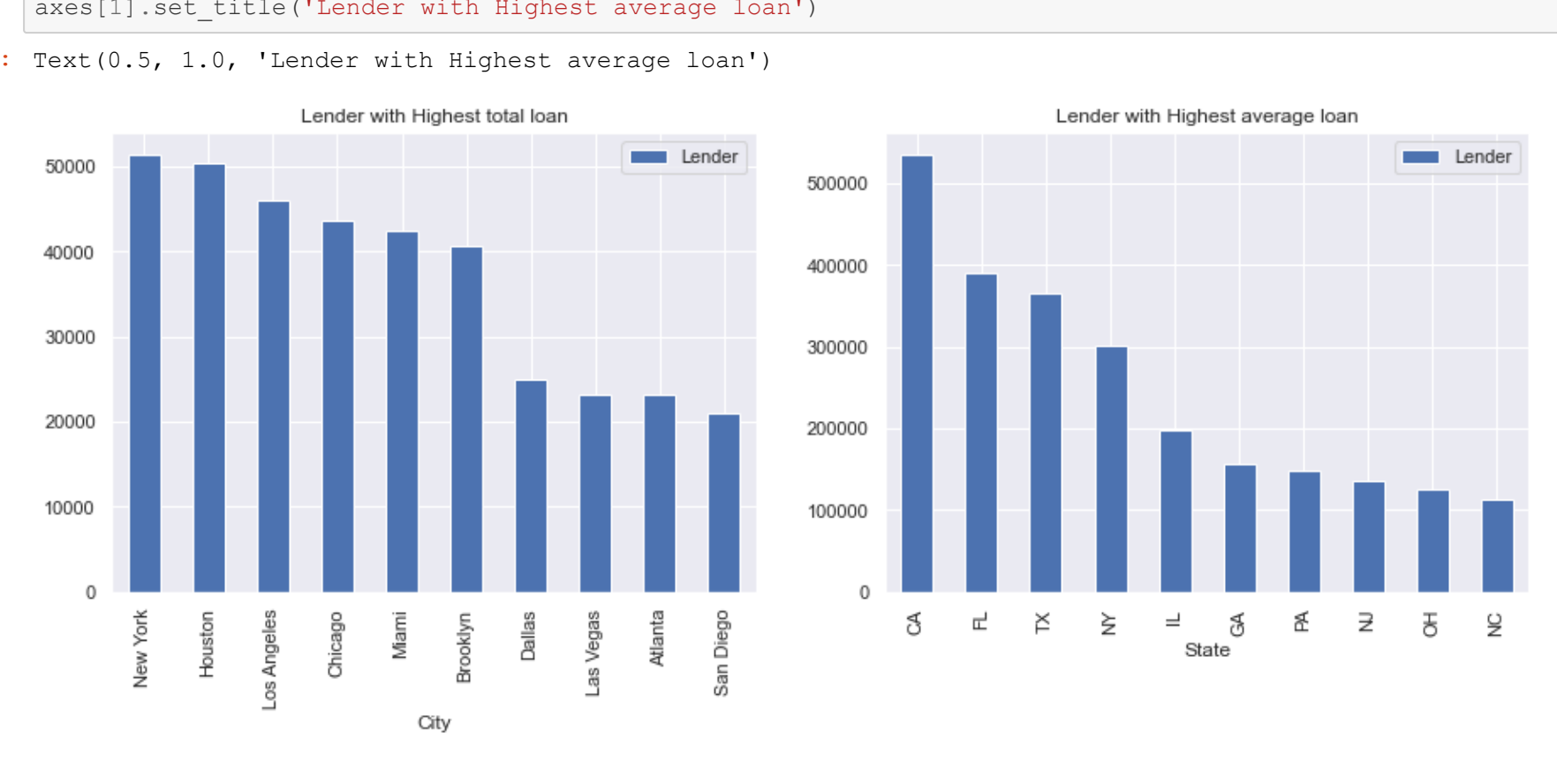
In [20]:
```
x1=df.groupby('City')['Lender'].count().sort_values(ascending=False)[:10]
x2=df.groupby('State')['Lender'].count().sort_values(ascending=False)[:10]

fig,axes=plt.subplots(nrows=1,ncols=2,figsize=(15,5))

x1.plot(kind='bar',ax=axes[0],legend=True)
x2.plot(kind='bar',ax=axes[1],legend=True)


axes[0].set_title('Lender with Highest total loan')
axes[1].set_title('Lender with Highest average loan')
```

Out[20]: Text(0.5, 1.0, 'Lender with Highest average loan')



Highest Lender from Each City

In [21]:
```
data=pd.DataFrame(df.groupby(['City','Lender'])['Lender'].count().sort_values(ascending=False))
data.columns=['Count']
data=data.reset_index()
data.columns=['City','Lender','Count']
data.head()
```

Out[21]:

	City	Lender	Count
0	New York	JPMorgan Chase Bank, National Association	13157
1	Brooklyn	JPMorgan Chase Bank, National Association	8298
2	Los Angeles	Bank of America, National Association	7160
3	Miami	Kabbage, Inc.	6381
4	Chicago	Cross River Bank	6337

Highest Lender from Each State

In [22]:
```
data=pd.DataFrame(df.groupby(['State','Lender'])['Lender'].count().sort_values(ascending=False))
data.columns=['Count']
data=data.reset_index()
data.columns=['State','Lender','Count']
data.head()
```

Out[22]:

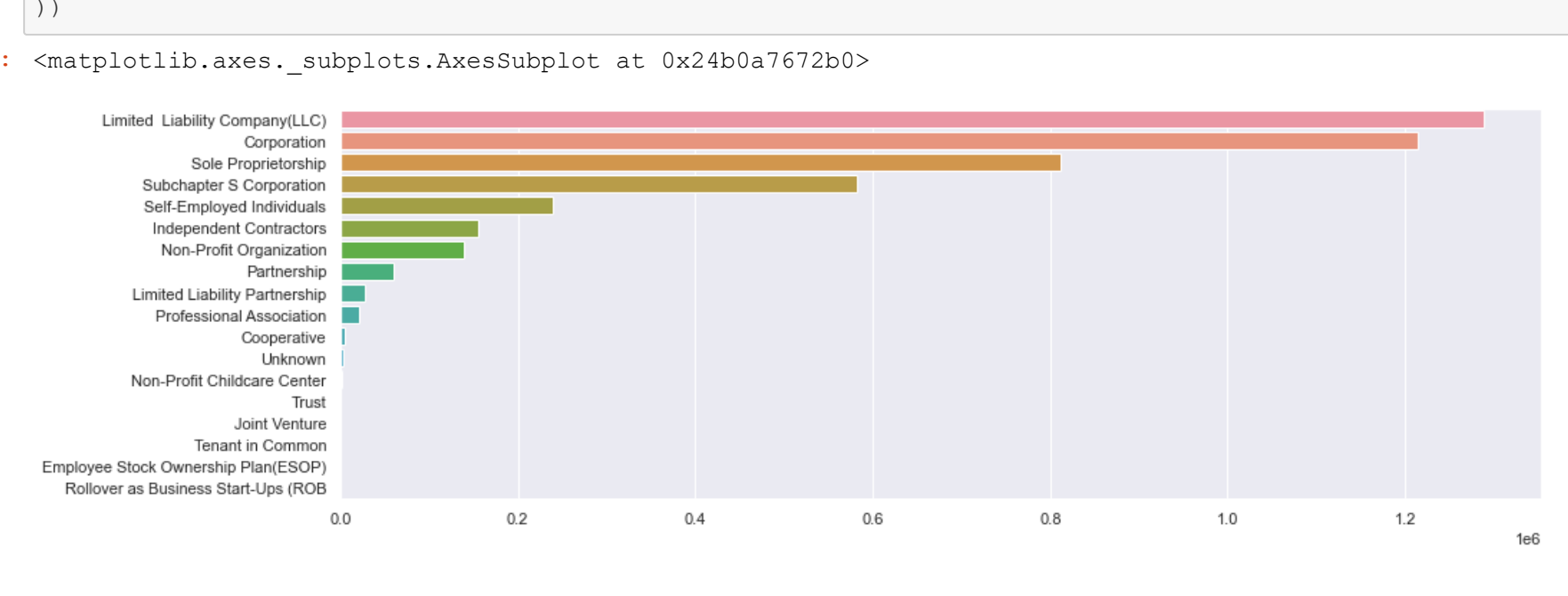
	State	Lender	Count
0	CA	Bank of America, National Association	84392
1	CA	Wells Fargo Bank, National Association	52573
2	NY	JPMorgan Chase Bank, National Association	51673
3	FL	Bank of America, National Association	51420
4	CA	JPMorgan Chase Bank, National Association	49625

Business Types

Most Preferred Business Types

In [23]:
```
plt.figure(figsize=(15,5))
sns.barplot(list(df['BusinessType'].value_counts().values),list(df['BusinessType'].value_counts().index
))
```

Out[23]: <matplotlib.axes._subplots.AxesSubplot at 0x24b0a7672b0>



Business Type And Loan Amount

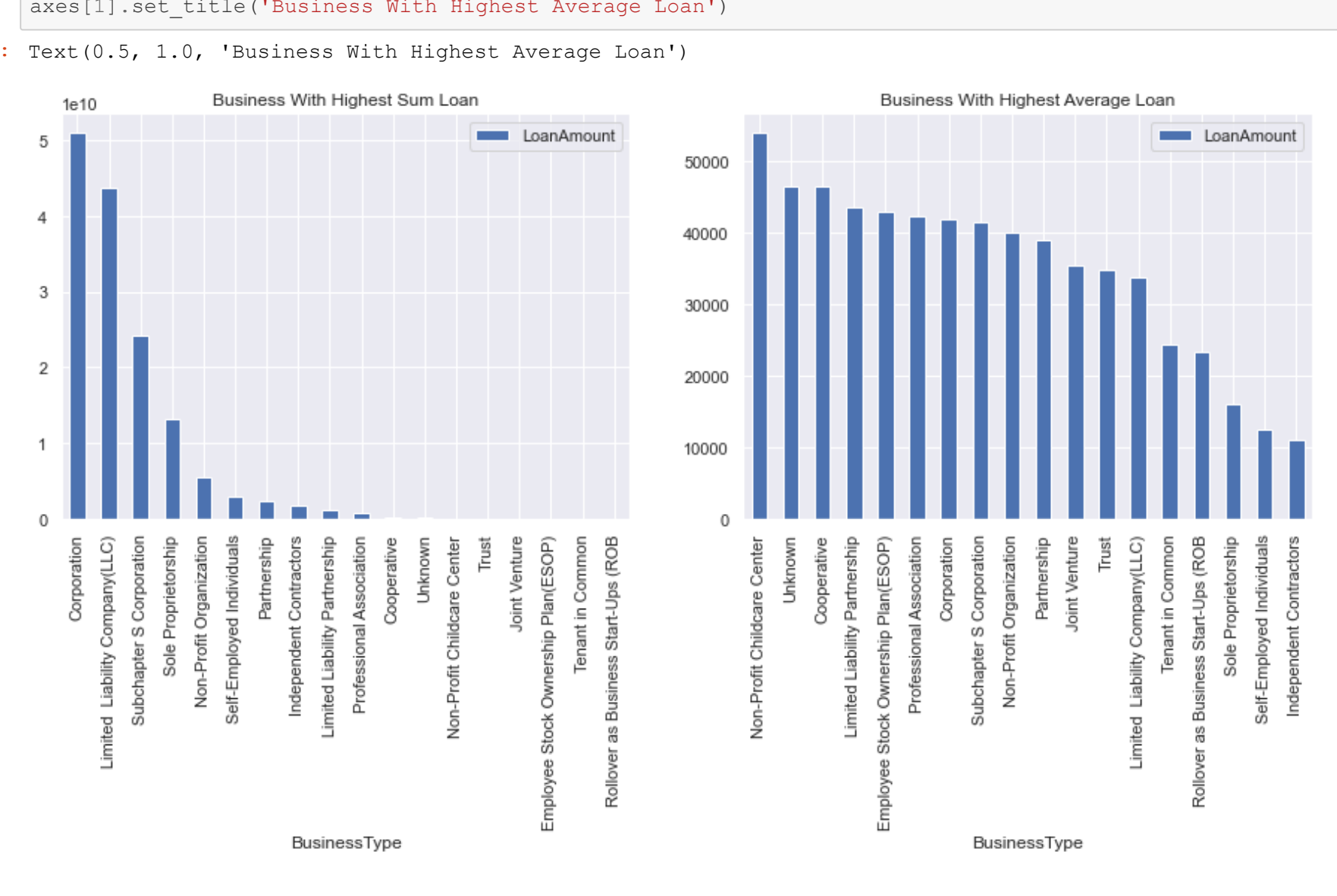
In [24]:
```
x1=df.groupby('BusinessType')['LoanAmount'].sum().sort_values(ascending=False)
x2=df.groupby('BusinessType')['LoanAmount'].mean().sort_values(ascending=False)
```

In [25]:
```
fig,axes=plt.subplots(nrows=1,ncols=2,figsize=(15,5))

x1.plot(kind='bar',ax=axes[0],legend=True)
x2.plot(kind='bar',ax=axes[1],legend=True)


axes[0].set_title('Business With Highest Sum Loan')
axes[1].set_title('Business With Highest Average Loan')
```

Out[25]: Text(0.5, 1.0, 'Business With Highest Average Loan')



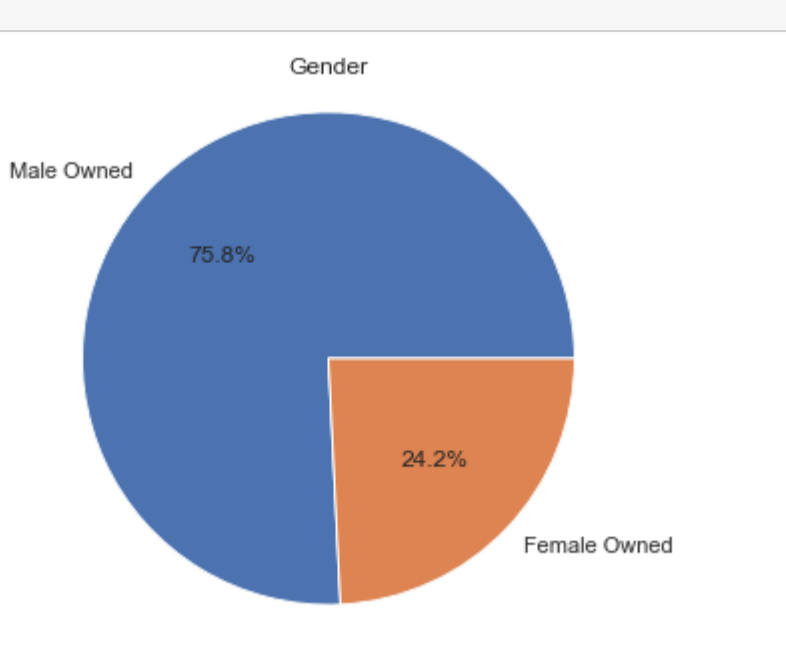
Business Type Owned Based on Gender, Race, Veterran

In [26]:
```
def f_count(col):
    data=df[df[col]!='Unanswered']
    x1=pd.DataFrame(data.groupby(['BusinessType',col])[col].count())
    x1.columns=['Count']
    #x1=x1.reset_index()
    return x1
```

In [27]:
```
def f_average(col):
    data=df[df[col]!='Unanswered']
    x1=pd.DataFrame(data.groupby(col)['LoanAmount'].mean().sort_values(ascending=False))
    x1.columns=['Average Loan Amount']
    x1=x1.reset_index()
    return x1
```

By Gender

In [28]:
```
data=df[df['Gender']!='Unanswered']
vals=list(data['Gender'].value_counts().values)
labels=list(data['Gender'].value_counts().index)
plt.figure(figsize=(10,5))
plt.pie(vals,labels=labels,autopct='%1.1f%%')
plt.title('Gender')
plt.axis('equal')
plt.show()
```



Business Type Owned By Different Gender

```
In [29]: data=f_count('Gender')
         data
```

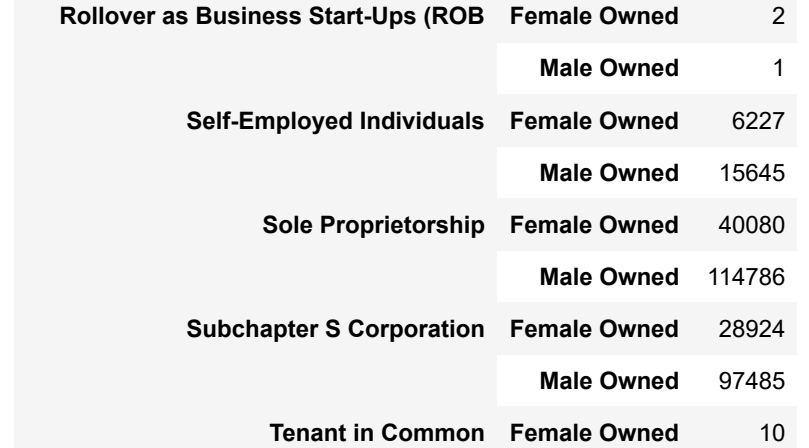
Out[29]:

BusinessType	Gender	Count
Cooperative	Female Owned	194
	Male Owned	746
Corporation	Female Owned	62421
	Male Owned	223777
Employee Stock Ownership Plan(ESOP)	Female Owned	11
	Male Owned	47
Independent Contractors	Female Owned	5482
	Male Owned	8742
Joint Venture	Female Owned	43
	Male Owned	114
Limited Liability Company(LLC)	Female Owned	69456
	Male Owned	209150
Limited Liability Partnership	Female Owned	1367
	Male Owned	4888
Non-Profit Childcare Center	Female Owned	246
	Male Owned	131
Non-Profit Organization	Female Owned	5605
	Male Owned	12098
Partnership	Female Owned	3001
	Male Owned	10315
Professional Association	Female Owned	927
	Male Owned	2621
Rollover as Business Start-Ups (ROB	Female Owned	2
	Male Owned	1
Self-Employed Individuals	Female Owned	6227
	Male Owned	15645
Sole Proprietorship	Female Owned	40080
	Male Owned	114786
Subchapter S Corporation	Female Owned	28924
	Male Owned	97485
Tenant in Common	Female Owned	10
	Male Owned	42
Trust	Female Owned	44
	Male Owned	136
Unknown	Female Owned	44
	Male Owned	202

Average Loan Amount By Business Type Based On Genders

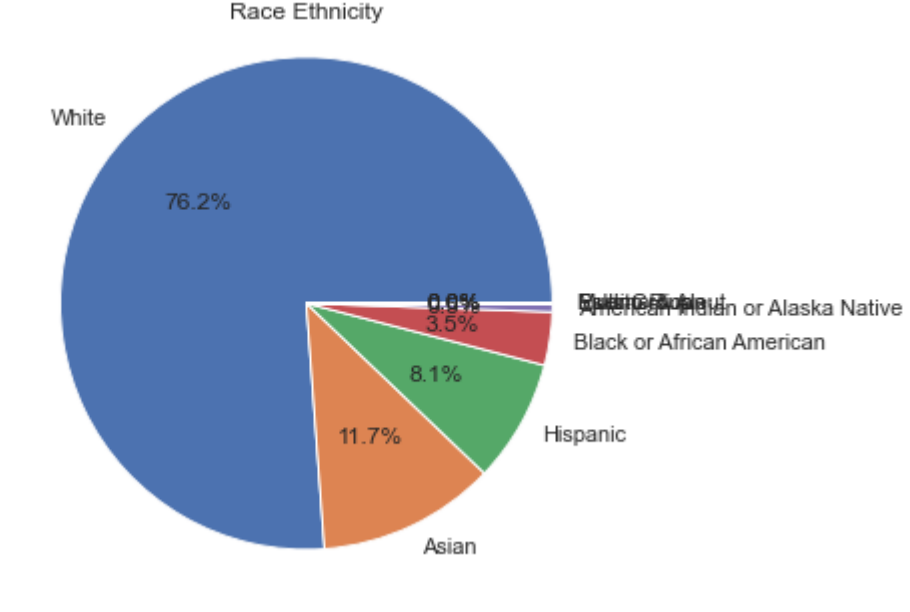
```
In [30]: data=f_average('Gender')
         sns.barplot(data['Gender'],data['Average Loan Amount'])
```

Out[30]: <matplotlib.axes._subplots.AxesSubplot at 0x24b0a3d21f0>



By Race Ethnicity

```
In [31]: data=df[df['RaceEthnicity']!='Unanswered']
         vals=list(data['RaceEthnicity'].value_counts().values)
         labels=list(data['RaceEthnicity'].value_counts().index)
         plt.figure(figsize=(10,5))
         plt.pie(vals,labels=labels,autopct='%1.1f%%')
         plt.title('Race Ethnicity')
         plt.axis('equal')
         plt.show()
```



Businedd Type Owners Race

```
In [32]: data=f_count('RaceEthnicity')
         data
```

Out[32]:

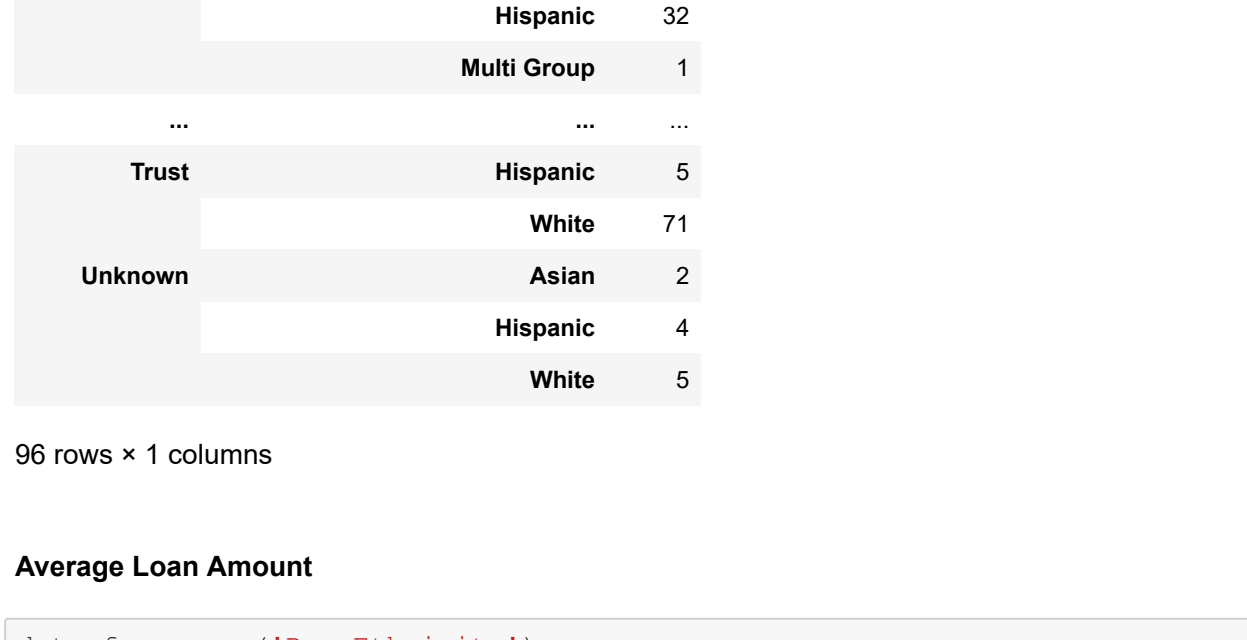
BusinessType	RaceEthnicity	Count
Cooperative	American Indian or Alaska Native	1
	Asian	81
	Black or African American	12
	Hispanic	32
	Multi Group	1
...	...	...
Trust	Hispanic	5
	White	71
Unknown	Asian	2
	Hispanic	4
	White	5

96 rows × 1 columns

Average Loan Amount

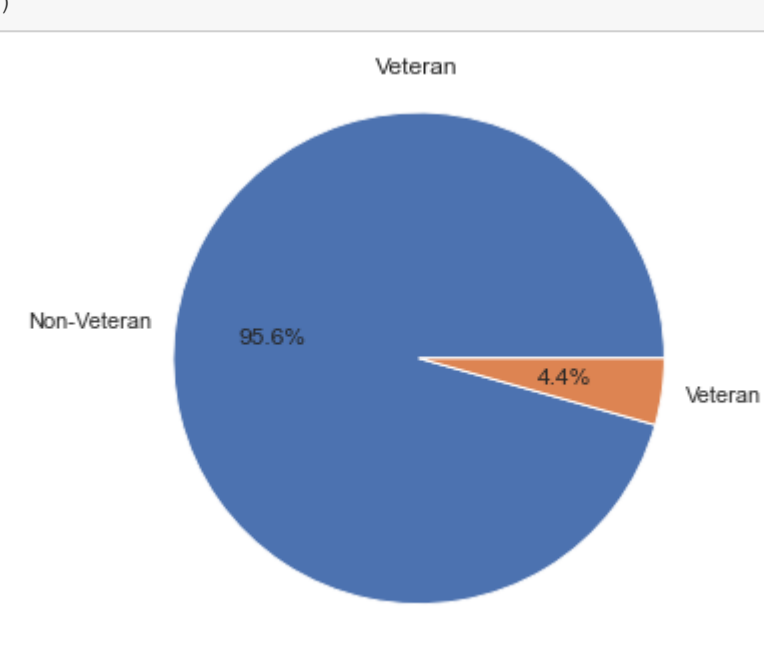
```
In [33]: data=f_average('RaceEthnicity')
         plt.figure(figsize=(10,5))
         sns.barplot(data['RaceEthnicity'],data['Average Loan Amount'])
         plt.xticks(rotation=90)
```

Out[33]: (array([0, 1, 2, 3, 4, 5, 6, 7]), <a list of 8 Text major ticklabel objects>)



Veteran

```
In [34]: data=df[df['Veteran']!='Unanswered']
         vals=list(data['Veteran'].value_counts().values)
         labels=list(data['Veteran'].value_counts().index)
         plt.figure(figsize=(10,5))
         plt.pie(vals,labels=labels,autopct='%1.1f%%')
         plt.title('Veteran')
         plt.axis('equal')
         plt.show()
```



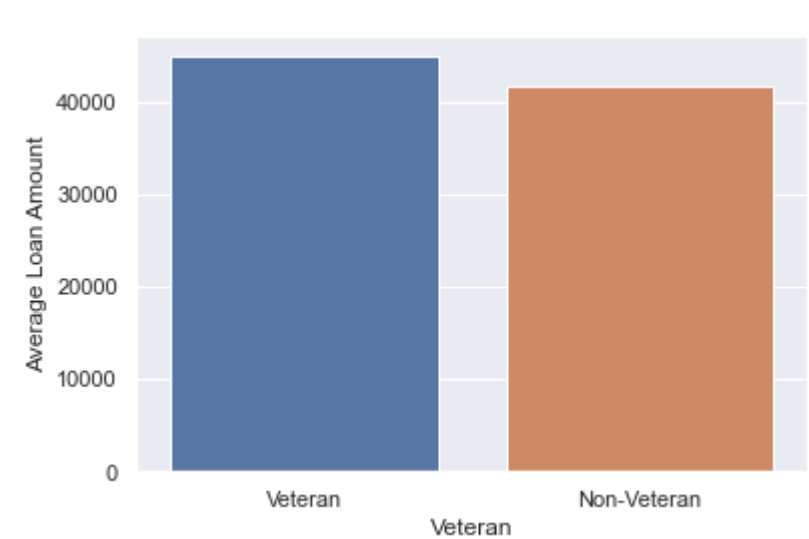

```
In [35]: data=f_count('Veteran')
         data
```

Out[35]:

BusinessType	Veteran	Count
Cooperative	Non-Veteran	580
	Veteran	23
Corporation	Non-Veteran	201222
	Veteran	9751
Employee Stock Ownership Plan(ESOP)	Non-Veteran	27
	Veteran	4
Independent Contractors	Non-Veteran	6872
	Veteran	188
Joint Venture	Non-Veteran	70
Limited Liability Company(LLC)	Non-Veteran	181042
	Veteran	9197
Limited Liability Partnership	Non-Veteran	4240
	Veteran	206
Non-Profit Childcare Center	Non-Veteran	147
	Veteran	4
Non-Profit Organization	Non-Veteran	6891
	Veteran	380
Partnership	Non-Veteran	7658
	Veteran	335
Professional Association	Non-Veteran	1928
	Veteran	95
Rollover as Business Start-Ups (ROB	Non-Veteran	1
Self-Employed Individuals	Non-Veteran	9791
	Veteran	256
Sole Proprietorship	Non-Veteran	93116
	Veteran	2945
Subchapter S Corporation	Non-Veteran	81128
	Veteran	3812
Tenant in Common	Non-Veteran	29
	Veteran	2
Trust	Non-Veteran	99
	Veteran	5
Unknown	Non-Veteran	218
	Veteran	6

```
In [36]: data=f_average('Veteran')
         sns.barplot(data['Veteran'],data['Average Loan Amount'])
```

Out[36]: <matplotlib.axes._subplots.AxesSubplot at 0x24b0a408dc0>

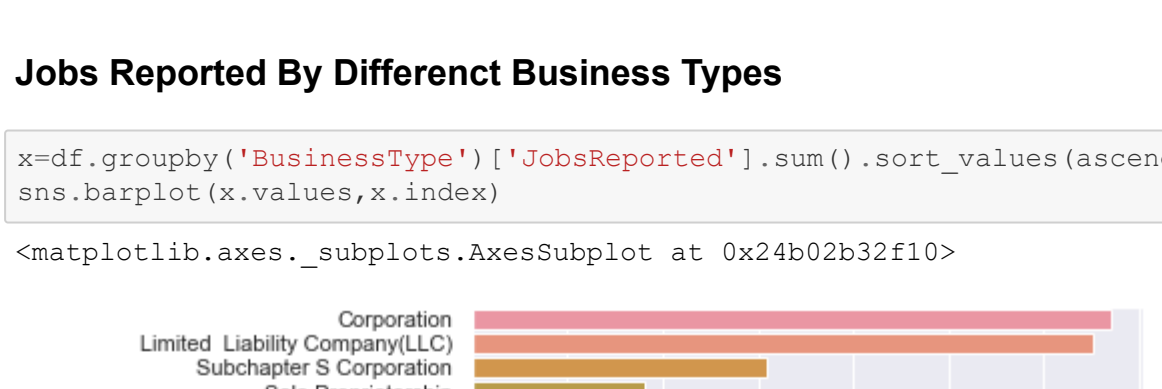


Jobs Reported

Jobs Reported By Differenct Business Types

```
In [37]: x=df.groupby('BusinessType')['JobsReported'].sum().sort_values(ascending=False)
         sns.barplot(x.values,x.index)
```

Out[37]: <matplotlib.axes._subplots.AxesSubplot at 0x24b02b32f10>



Cities And States with Most Jobs Reported (Top 10)

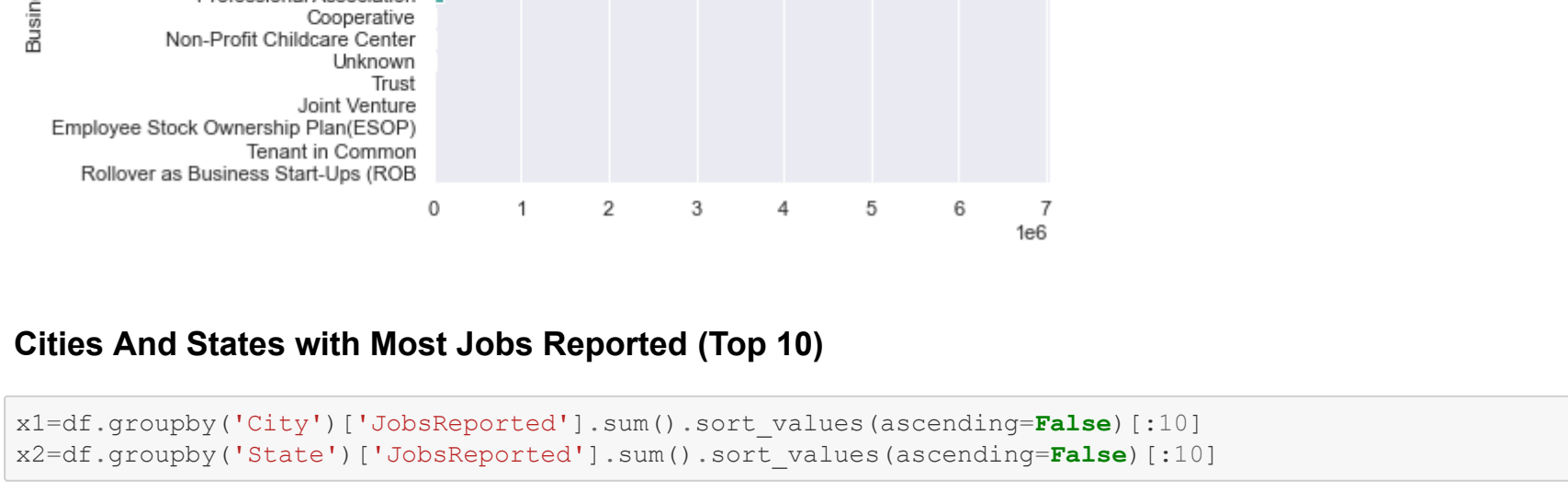
```
In [38]: x1=df.groupby('City')['JobsReported'].sum().sort_values(ascending=False)[:10]
         x2=df.groupby('State')['JobsReported'].sum().sort_values(ascending=False)[:10]
```

```
In [39]: fig,axes=plt.subplots(nrows=1,ncols=2,figsize=(15,5))

         x1.plot(kind='bar',ax=axes[0],legend=True)
         x2.plot(kind='bar',ax=axes[1],legend=True)


         axes[0].set_title('Cities')
         axes[1].set_title('States')
```

Out[39]: Text(0.5, 1.0, 'States')

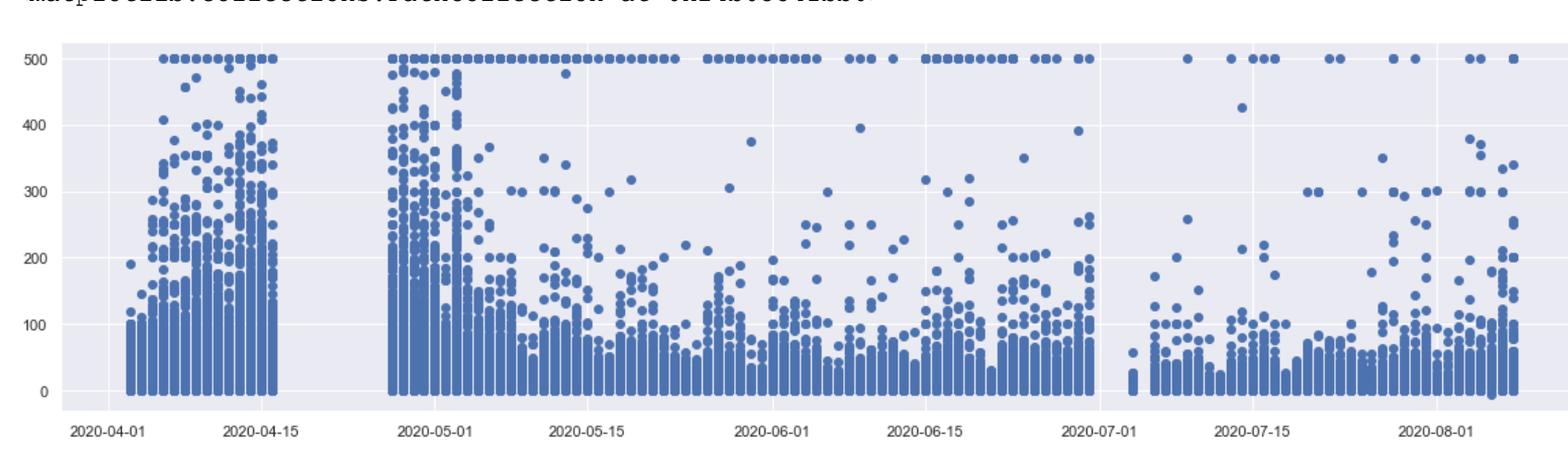


Time Series Analysis (Jobs Reported And Loan Amount)

```
In [40]: data=df.loc[:,['JobsReported','DateApproved','LoanAmount']]
         data.index=data['DateApproved']
         data.drop('DateApproved',axis=1,inplace=True)
```

```
In [41]: plt.figure(figsize=(20,5))
         plt.scatter(data.index,data['JobsReported'])
```

Out[41]: <matplotlib.collections.PathCollection at 0x24b0354fbb0>



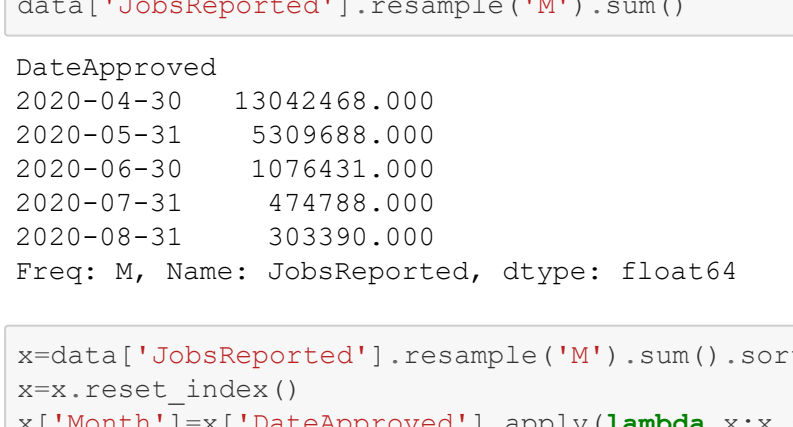
Jobs Reported In each month

```
In [42]: data['JobsReported'].resample('M').sum()
```

```
Out[42]: DateApproved
         2020-04-30    13042468.000
         2020-05-31     5309688.000
         2020-06-30     1076431.000
         2020-07-31      474788.000
         2020-08-31      303390.000
         Freq: M, Name: JobsReported, dtype: float64
```

```
In [43]: x=data['JobsReported'].resample('M').sum().sort_values(ascending=False)
         x=x.reset_index()
         x['Month']=x['DateApproved'].apply(lambda x:x.strftime("%b"))
         sns.barplot(x['Month'],x['JobsReported'])
```

Out[43]: <matplotlib.axes._subplots.AxesSubplot at 0x24b03582ee0>



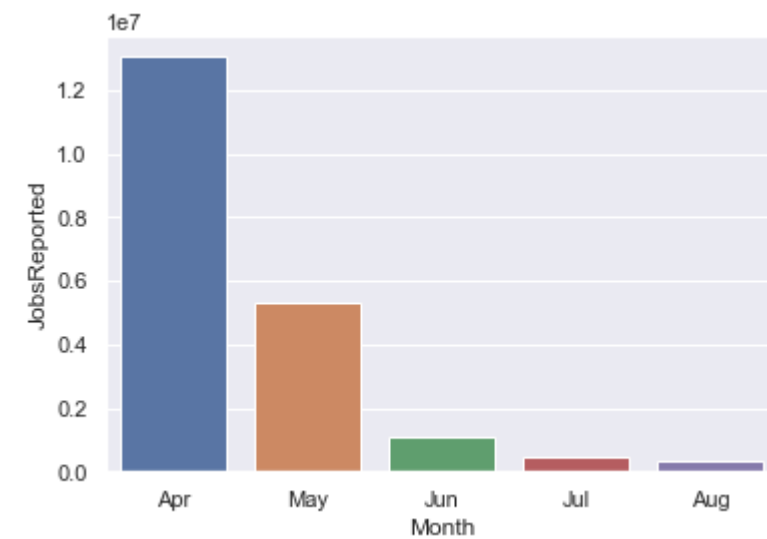
Loan Amount Sum in each Month

```
In [44]: data['LoanAmount'].resample('M').sum()
```

```
Out[44]: DateApproved
         2020-04-30    93940125492.879
         2020-05-31    38945714680.000
         2020-06-30     7739043440.725
         2020-07-31     4005993685.710
         2020-08-31     2420810218.520
         Freq: M, Name: LoanAmount, dtype: float64
```

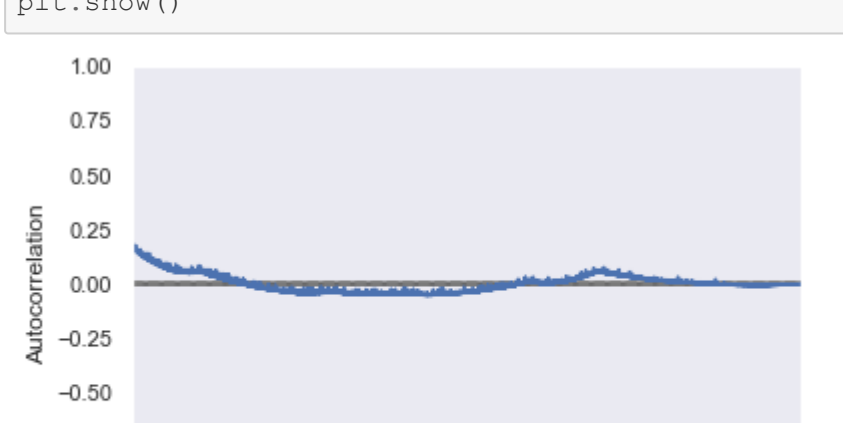
```
In [45]: x=data['LoanAmount'].resample('M').sum().sort_values(ascending=False)
         x=x.reset_index()
         x['Month']=x['DateApproved'].apply(lambda x:x.strftime("%b"))
         sns.barplot(x['Month'],x['LoanAmount'])
```

Out[45]: <matplotlib.axes._subplots.AxesSubplot at 0x24b0b245460>

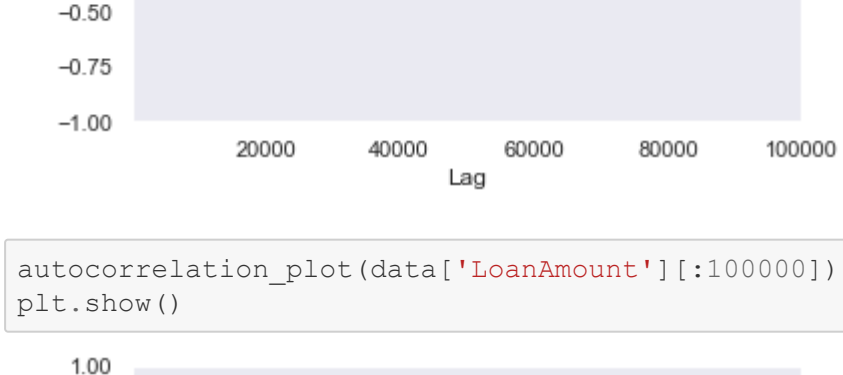


Checking for Random Walk (If current Value is related to previous values)

```
In [46]: autocorrelation_plot(data['JobsReported'][:100000])
         plt.show()
```




```
In [47]: autocorrelation_plot(data['LoanAmount'][:100000])
         plt.show()
```



Stationarity Check

```
In [70]: data=df.loc[:100000,['DateApproved','JobsReported','LoanAmount']]
         data=data.sort_index()
         data.index=data['DateApproved']
         data.drop('DateApproved',axis=1,inplace=True)
```

```
In [71]: X=data['JobsReported']

         result = adfuller(X)
         print('ADF Statistic: %f' % result[0])
         print('p-value: %f' % result[1])
         print('Critical Values:')

         for key, value in result[4].items():
             print('\t%s: %.3f' % (key, value))
```

```
ADF Statistic: -10.100130
p-value: 0.000000
Critical Values:
        1%: -3.430
        5%: -2.862
        10%: -2.567
```

```
In [72]: X=data['LoanAmount']

         result = adfuller(X)
         print('ADF Statistic: %f' % result[0])
         print('p-value: %f' % result[1])
         print('Critical Values:')

         for key, value in result[4].items():
             print('\t%s: %.3f' % (key, value))
```

```
ADF Statistic: -3.971424
p-value: 0.001568
Critical Values:
        1%: -3.430
        5%: -2.862
        10%: -2.567
```

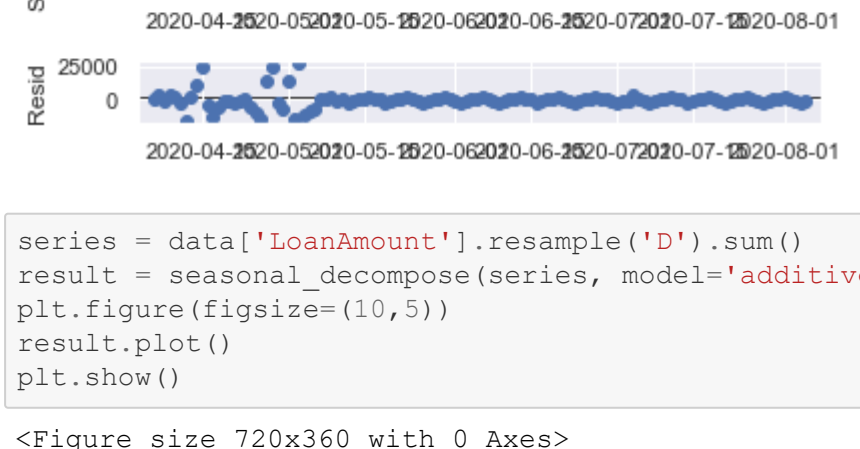
Seasonality Check

```
In [73]: series = data['JobsReported'].resample('D').sum()
         result = seasonal_decompose(series, model='additive')
         plt.figure(figsize=(10,5))
         result.plot()
         plt.show()
```

<Figure size 720x360 with 0 Axes>

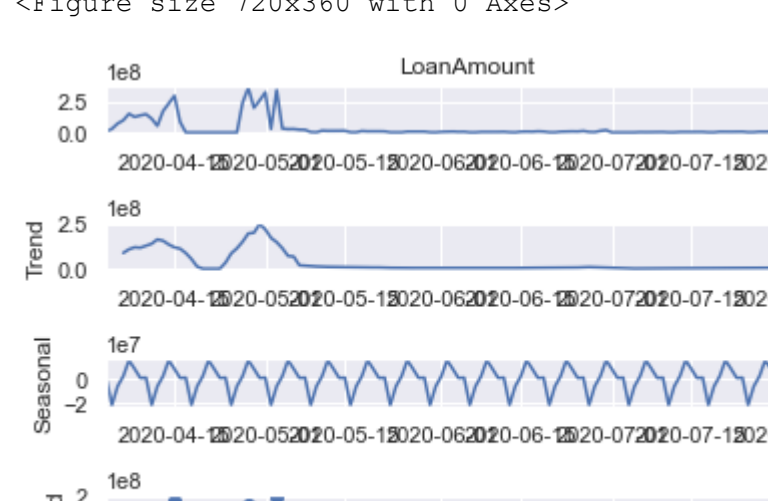

```
In [74]: series = data['LoanAmount'].resample('D').sum()
         result = seasonal_decompose(series, model='additive')
         plt.figure(figsize=(10,5))
         result.plot()
         plt.show()
```

<Figure size 720x360 with 0 Axes>

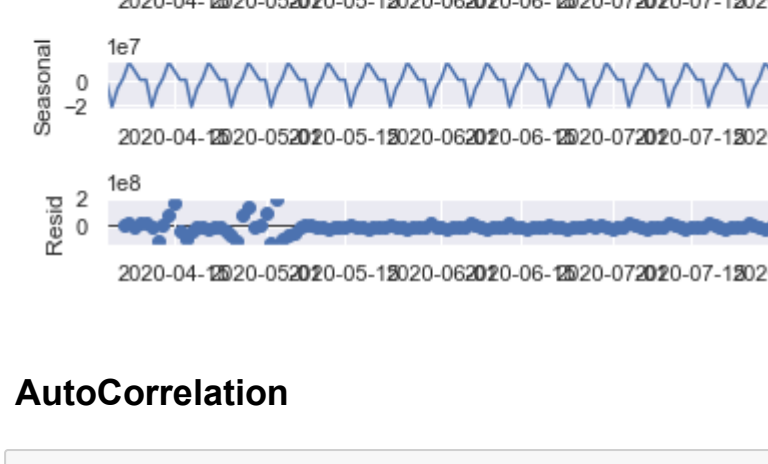


AutoCorrelation

```
In [75]: sgt.plot_acf(data['JobsReported'],lags=40,zero=False)
         plt.show()
```




```
In [76]: sgt.plot_acf(data['LoanAmount'],lags=40,zero=False)
         plt.show()
```



Forecasting

```
In [77]: data1=data.loc[:,['JobsReported']]
         data1=data1.resample('D').sum()
         data_train=data1[['JobsReported']]
         data_train=data_train.reset_index()
         data_train.columns=['ds','y']
         model = Prophet( yearly_seasonality=True) #instantiate Prophet with only yearly seasonality as our data
          is monthly
         model.fit(data_train) #
```

```
INFO:numexpr.utils:NumExpr defaulting to 8 threads.
INFO:fbprophet:Disabling daily seasonality. Run prophet with daily_seasonality=True to override this.
```

Out[77]: <fbprophet.forecaster.Prophet at 0x24b27659a00>

```
In [78]: # predict for five months in the furure and MS - month start is the frequency
         future = model.make_future_dataframe(periods = 20)
         # now lets make the forecasts
         forecast = model.predict(future)
         forecast = forecast.loc[len(data_train):]
         forecast = forecast[['ds', 'yhat']]
         forecast.columns=['Date','JobsReported']
         data_train.columns=['Date','JobsReported']
```

```
In [79]: data_train['JobsReported'].plot(figsize=(20,8),color='red',label='Actual')
         forecast['JobsReported'].plot(figsize=(20,8),color='blue',label='Predicted')
         plt.legend()
```

Out[79]: <matplotlib.legend.Legend at 0x24b2855ab50>


```
In [ ]:
```