In [1]:

```
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LinearRegression
from sklearn.metrics import mean_squared_error, r2_score
```

In [2]:

```
import numpy as np, pandas as pd, matplotlib.pyplot as plt, seaborn
from datetime import datetime, timedelta
from fredapi import Fred
import quandl
```

In [3]:

```
def get_info(names):
    data = []
    for i in range(len(names)):
        data.append(fred.get_series(names[i]).to_frame().rename(col
        data[i] = data[i].groupby(data[i].index.year).mean().dropna
    return data
```

In [4]:

```
# https://github.com/mortada/fredapi
fred = Fred(api_key="a02df0a22c57860f5f7cf25edc70ffb3")
quandl.ApiConfig.api_key = "QZLZXdHDDPZna9Yw48NP"
```

Northeast - New York

Define the variables to be used in analysis:

X attributes:

- *Monthly* Stocks
    - S&P 500 (MULTPL/SP500_REAL_PRICE_MONTH)
- *Quarterly* Gross Domestic Product (GDP)
- *Annual* Unemployment Rate (LAUST360000000000003A)
- *Annual* House Ownership Ratio (NYHOWN)
- *Annual* Resident Population (NYPOP)
- *Annual* Median Income Rate (MEHOINUSNYA672N)
- *Annual* Home Vacancy Rate (NYHVAC)

y attributes:

- *Quarterly* New York State Housing Price Index (NYSTHPI)

Connect to APIs and create a dataframe with information from each dataset:

In [5]:

```
sp500 = quandl.get('MULTPL/SP500_REAL_PRICE_MONTH').rename(columns=
sp500 = sp500.groupby(sp500.index.year).mean().dropna()
names_ny = ['LAUST360000000000003A', "NYHOWN","NYPOP", "MEHOINUSNYA
ny_data_series = get_info(names_ny) + [sp500]
```

In [6]:

```
# quarterly housing price index
nyHPI = fred.get_series('NYSTHPI').to_frame()
nyHPI.index.name = "DATE"
nyHPI = nyHPI.rename(columns={0:"NYSTHPI"})
# convert to annual
nyHPI_annual = nyHPI.groupby(nyHPI.index.year).mean()
```

In [7]:

```
ny_annual = nyHPI_annual.copy()
for df in ny_data_series:
    ny_annual = ny_annual.merge(df, left_index=True, right_index=Tr
ny_annual.tail()
```

Out[7]:

	NYSTHPI	LAUST360000000000003A	NYHOWN	NYPOP	MEHOINUS
2014	570.9975	6.3	52.9	19656.330	
2015	591.8425	5.3	51.5	19661.411	
2016	613.9100	4.9	51.5	19641.589	
2017	644.7200	4.7	51.1	19590.719	
2018	682.2450	4.1	51.0	19542.209	

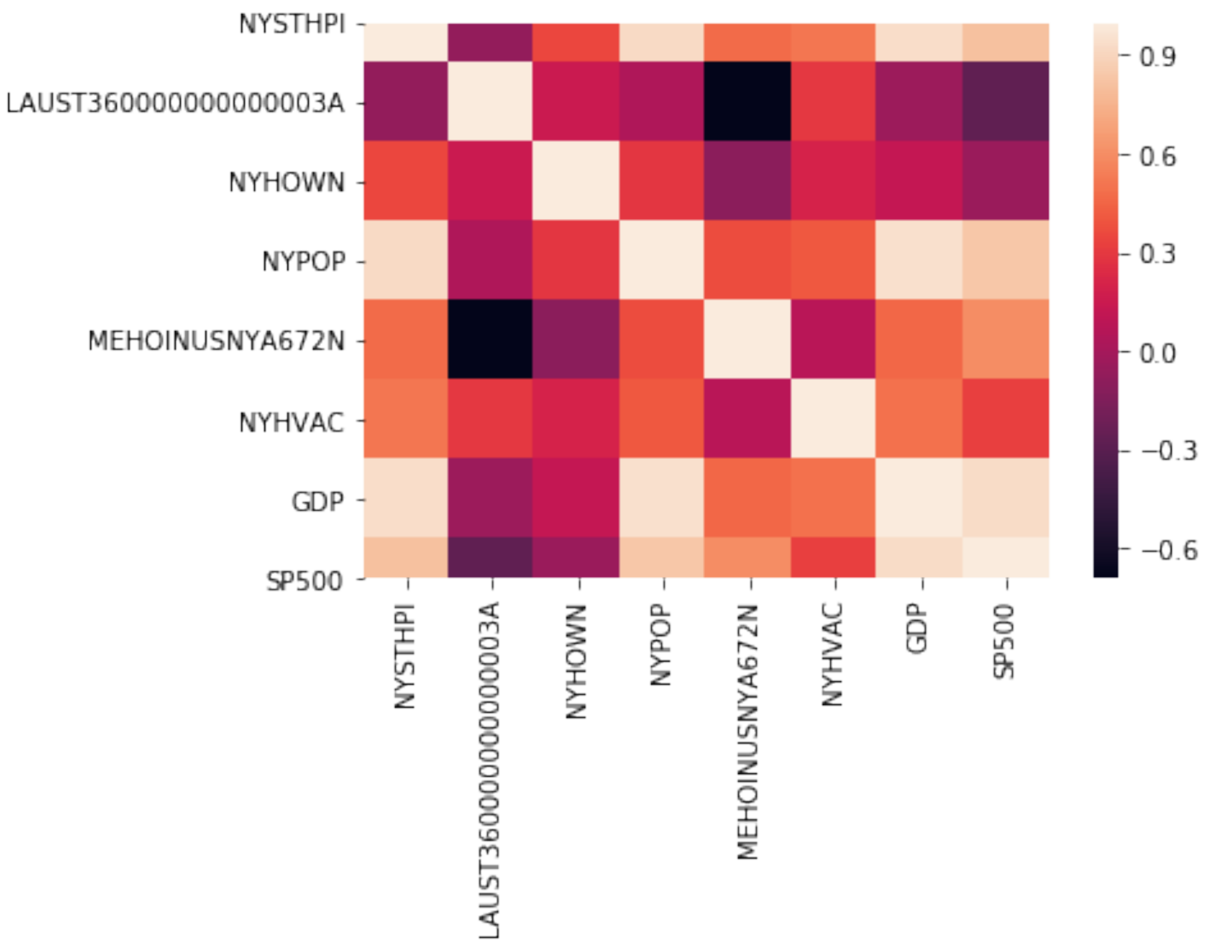
Analyze the correlation coefficient for each indicator we have specified:

In [8]:

```
corr = ny_annual.corr().round(4)
sns.heatmap(data=corr)
```

Out[8]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x129e436a0>
```



```
In [9]:
```

```
corr
```

```
Out[9]:
```

	NYSTHPI	LAUST360000000000003A	NYHOWN	N
NYSTHPI	1.0000	-0.0679	0.3505	(
LAUST360000000000003A	-0.0679	1.0000	0.1524	(
NYHOWN	0.3505	0.1524	1.0000	(
NYPOP	0.9229	0.0372	0.2901	1
MEHOINUSNYA672N	0.4768	-0.6925	-0.1009	(
NYHVAC	0.5110	0.2963	0.2004	(
GDP	0.9399	-0.0336	0.1265	(
SP500	0.8121	-0.2694	-0.0416	(

Create a model using linear regression to express the Case-Schiller index as dependent on the other datasets we have downloaded:

```
In [10]:
```

```
X = ny_annual.drop(columns=['NYSTHPI'], axis=1)
Y = ny_annual['NYSTHPI']
X_train, X_test, Y_train, Y_test = train_test_split(X, Y, test_size
lin_model = LinearRegression()
lin_model.fit(X_train, Y_train)
```

```
Out[10]:
```

```
LinearRegression(copy_X=True, fit_intercept=True, n_jo
bs=None, normalize=False)
```

In [11]:

```
# model evaluation for training set
y_train_predict = lin_model.predict(X_train)
rmse = (np.sqrt(mean_squared_error(Y_train, y_train_predict)))
r2 = r2_score(Y_train, y_train_predict)

print("The model performance for training set")
print("--------------------------------------")
print('Root Mean Squared Error is {}'.format(rmse))
print('R-Squared score is {}'.format(r2))
print("\n")

# model evaluation for testing set
y_test_predict = lin_model.predict(X_test)
rmse = (np.sqrt(mean_squared_error(Y_test, y_test_predict)))
r2 = r2_score(Y_test, y_test_predict)

print("The model performance for testing set")
print("--------------------------------------")
print('Root Mean Squared Error is {}'.format(rmse))
print('R-Squared score is {}'.format(r2))
```

```
The model performance for training set
--------------------------------------
Root Mean Squared Error is 20.550389410992903
R-Squared score is 0.9820594540751048


The model performance for testing set
--------------------------------------
Root Mean Squared Error is 31.309697006192742
R-Squared score is 0.952166261889279
```

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In [2]:

```
```

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```
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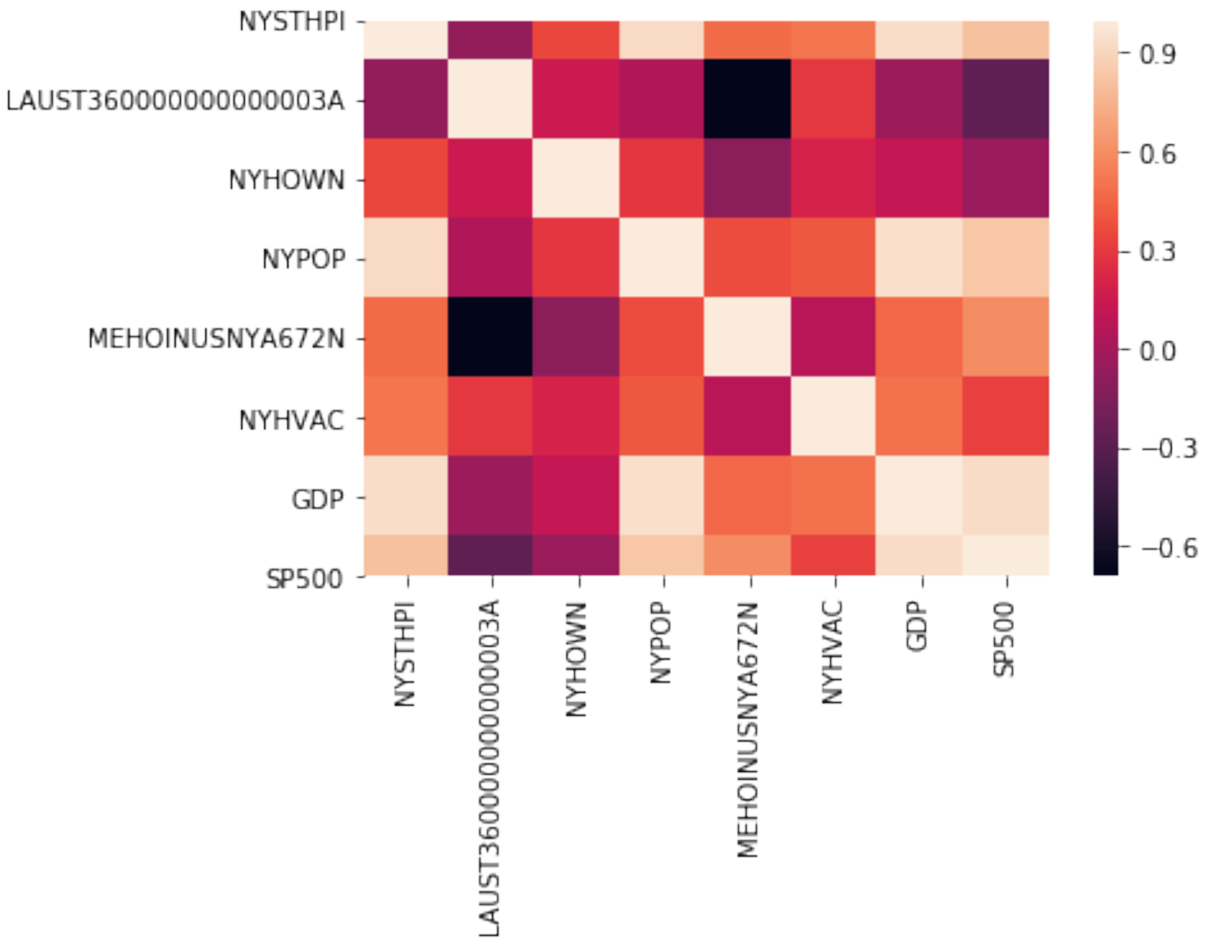
NYSTHPI
LAUST360000000000003A
NYHOWN
NYPOP
MEHOINUSNYA672N
NYHVAC
GDP
SP500
0.9
0.6
0.3
0.0
−0.3
−0.6

```
In [9]:
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```
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