In [46]:
```
import panel as pn
pn.extension('plotly')
import plotly.express as px
import pandas as pd
import matplotlib.pyplot as plt
import numpy as np
import os
from pathlib import Path
from dotenv import load_dotenv

import warnings
warnings.filterwarnings('ignore')

import hvplot.pandas
```

In [2]:
```
load_dotenv()
map_box_api = os.getenv("mapbox_token")
px.set_mapbox_access_token(map_box_api)
type(map_box_api)
```

Out[2]: str

In [ ]:

In [3]:
```
# housing units per year

## rental analysis
```

In [ ]:

In [4]:
```
sfo_data = pd.read_csv("C:/Users/danie/smu_files/sfo_neighborhoods_census_data.csv", in
sfo_data.head()
```

Out[4]:

year	neighborhood	sale_price_sqr_foot	housing_units	gross_rent
2010	Alamo Square	291.182945	372560	1239
2010	Anza Vista	267.932583	372560	1239
2010	Bayview	170.098665	372560	1239
2010	Buena Vista Park	347.394919	372560	1239
2010	Central Richmond	319.027623	372560	1239

In [5]:
```
sfo_mean = sfo_data.groupby("year").mean()
sfo_mean
```

Out[5]:

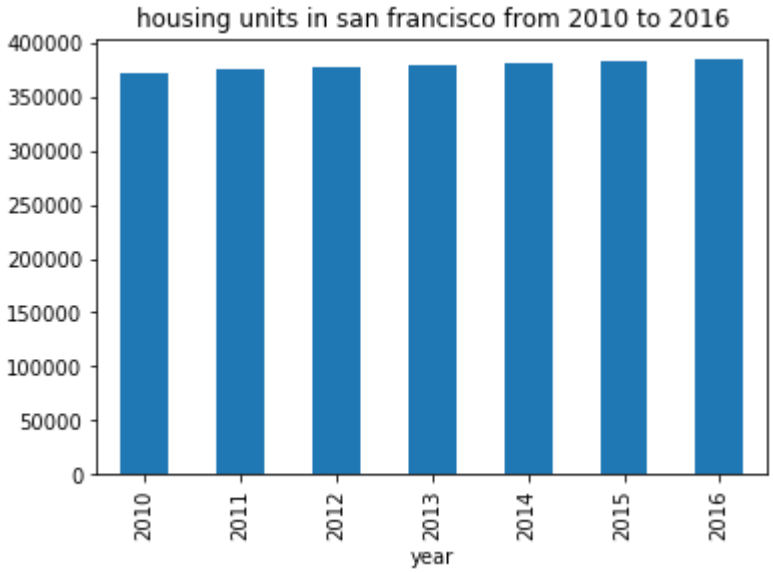
year	sale_price_sqr_foot	housing_units	gross_rent
2010	369.344353	372560	1239
2011	341.903429	374507	1530

year	sale_price_sqr_foot	housing_units	gross_rent
2012	399.389968	376454	2324
2013	483.600304	378401	2971
2014	556.277273	380348	3528
2015	632.540352	382295	3739
2016	697.643709	384242	4390

In [6]:
```
housing_units_mean = sfo_mean["housing_units"]
housing_units_mean
```

Out[6]:
```
year
2010    372560
2011    374507
2012    376454
2013    378401
2014    380348
2015    382295
2016    384242
Name: housing_units, dtype: int64
```

In [7]:
```
housing_units_plots = housing_units_mean.plot.bar(title='housing units in san francisco
```



In [ ]:

In [8]:
```
# housing costs in san francisco per year
```

In [ ]:

In [9]:
```
sfo_mean[['sale_price_sqr_foot','gross_rent']]
```

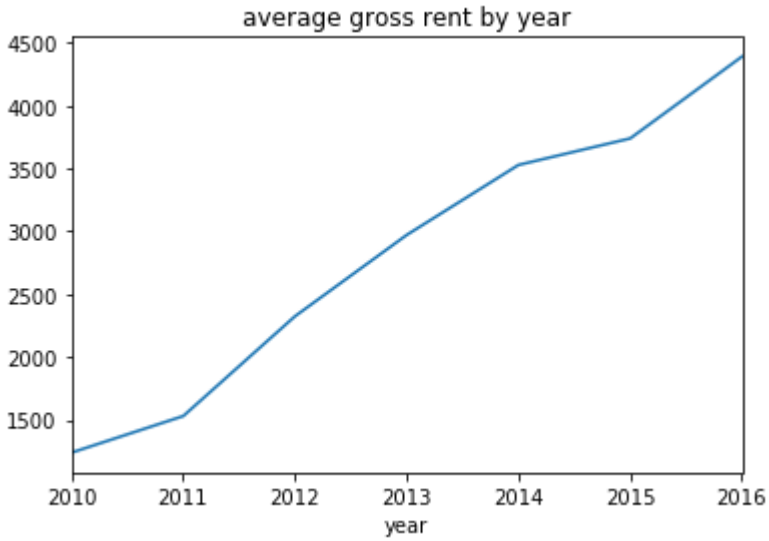
Out[9]:

year	sale_price_sqr_foot	gross_rent

year	sale_price_sqr_foot	gross_rent
2010	369.344353	1239
2011	341.903429	1530
2012	399.389968	2324
2013	483.600304	2971
2014	556.277273	3528
2015	632.540352	3739
2016	697.643709	4390

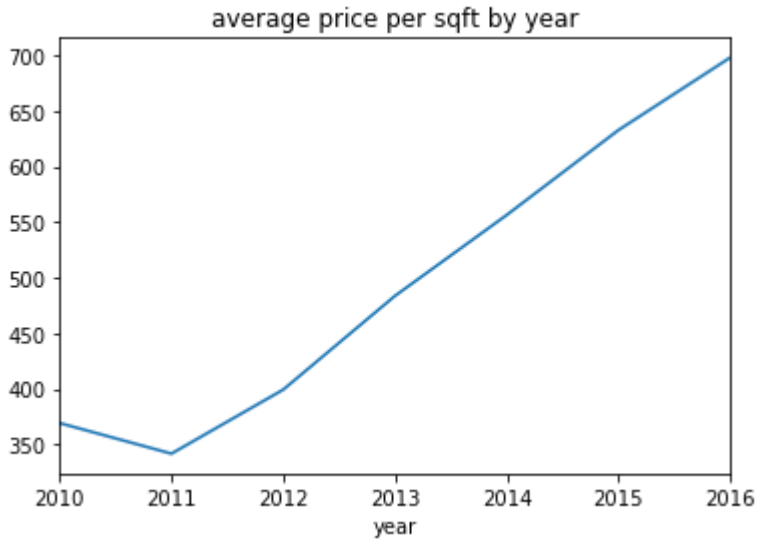
In [10]:
```
gross_rent = sfo_mean['gross_rent']
```

In [11]:
```
gross_rents_plot = gross_rent.plot(title= 'average gross rent by year')
```



In [12]:
```
sale_price_sqr_foot=sfo_mean['sale_price_sqr_foot']
```

In [13]:
```
rent_plot = sale_price_sqr_foot.plot(title = "average price per sqft by year")
```



In [ ]:

In [14]:
```
# average prices by neighborhood
```

In [ ]:

In [15]:
```
year_neighborhood = sfo_data.groupby(["year","neighborhood"]).mean().reset_index()
year_neighborhood.head(10)
```

Out[15]:

	year	neighborhood	sale_price_sqr_foot	housing_units	gross_rent
0	2010	Alamo Square	291.182945	372560	1239
1	2010	Anza Vista	267.932583	372560	1239
2	2010	Bayview	170.098665	372560	1239
3	2010	Buena Vista Park	347.394919	372560	1239
4	2010	Central Richmond	319.027623	372560	1239
5	2010	Central Sunset	418.172493	372560	1239
6	2010	Corona Heights	369.359338	372560	1239
7	2010	Cow Hollow	569.379968	372560	1239
8	2010	Croker Amazon	165.645730	372560	1239
9	2010	Diamond Heights	456.930822	372560	1239

In [16]:
```
neighborhood_sales = year_neighborhood.hvplot.line(x='year',y='sale_price_sqr_foot', gr
```

In [17]:
```
neighborhood_sales
```

Out[17]:

In [18]:
```
neighborhood_rents = year_neighborhood.hvplot.line(x='year',y='gross_rent', groupby='ne
```

In [19]:
```
neighborhood_rents
```

Out[19]:

In [ ]:

In [20]:
```
# top 10 most expensive neighborhoods in SFO
```

In [ ]:

In [21]:
```
ten_most_expensive=sfo_data.groupby(["neighborhood"]).mean().sort_values('sale_price_sq
ascending = False).head(10).reset_index()
ten_most_expensive
```

Out[21]:

	neighborhood	sale_price_sqr_foot	housing_units	gross_rent
0	Union Square District	903.993258	377427.50	2555.166667
1	Merced Heights	788.844818	380348.00	3414.000000
2	Miraloma Park	779.810842	375967.25	2155.250000
3	Pacific Heights	689.555817	378401.00	2817.285714
4	Westwood Park	687.087575	382295.00	3959.000000
5	Telegraph Hill	676.506578	378401.00	2817.285714
6	Presidio Heights	675.350212	378401.00	2817.285714
7	Cow Hollow	665.964042	378401.00	2817.285714
8	Potrero Hill	662.013613	378401.00	2817.285714
9	South Beach	650.124479	375805.00	2099.000000

In [22]:
```
top_10 = ten_most_expensive.hvplot.bar(x='neighborhood',y='sale_price_sqr_foot', title
rot = 45, height = 500)
```

In [23]:
```
top_10
```

Out[23]:

In [ ]:

In [24]:
```
# comparing cost to purchase versus rental income
```

In [ ]:

In [25]:
```
year_neighborhood.head()
```

Out[25]:

	year	neighborhood	sale_price_sqr_foot	housing_units	gross_rent
0	2010	Alamo Square	291.182945	372560	1239
1	2010	Anza Vista	267.932583	372560	1239
2	2010	Bayview	170.098665	372560	1239

	year	neighborhood	sale_price_sqr_foot	housing_units	gross_rent
3	2010	Buena Vista Park	347.394919	372560	1239
4	2010	Central Richmond	319.027623	372560	1239

In [26]:
```
side_by_side=year_neighborhood.drop(['housing_units'], axis=1)
side_by_side.head()
```

Out[26]:

	year	neighborhood	sale_price_sqr_foot	gross_rent
0	2010	Alamo Square	291.182945	1239
1	2010	Anza Vista	267.932583	1239
2	2010	Bayview	170.098665	1239
3	2010	Buena Vista Park	347.394919	1239
4	2010	Central Richmond	319.027623	1239

In [ ]:

In [27]:
```
side_plot = side_by_side.hvplot.bar('year', groupby = 'neighborhood', rot=90, title = \
'average price per square foot versus average monthly rent by year by neighborhood', he
```

In [28]:
```
side_plot
```

Out[28]:

In [ ]:

In [29]:
```
# neighborhood map
```

In [ ]:

In [30]:
```
coordinates = pd.read_csv('C:/Users/danie/smu_files/neighborhoods_coordinates.csv')
coordinates.head()
```

Out[30]:

	Neighborhood	Lat	Lon
0	Alamo Square	37.791012	-122.402100
1	Anza Vista	37.779598	-122.443451
2	Bayview	37.734670	-122.401060
3	Bayview Heights	37.728740	-122.410980
4	Bernal Heights	37.728630	-122.443050

In [31]:
```
map_data = sfo_data.groupby("neighborhood").mean().reset_index()
map_data.head()
```

Out[31]:

	neighborhood	sale_price_sqr_foot	housing_units	gross_rent

	neighborhood	sale_price_sqr_foot	housing_units	gross_rent
0	Alamo Square	366.020712	378401.0	2817.285714
1	Anza Vista	373.382198	379050.0	3031.833333
2	Bayview	204.588623	376454.0	2318.400000
3	Bayview Heights	590.792839	382295.0	3739.000000
4	Bernal Heights	576.746488	379374.5	3080.333333

In [32]:
```
map_data.shape
```

Out[32]:
```
(73, 4)
```

In [33]:
```
combined_map = pd.concat([coordinates,map_data], axis = 1, join = 'inner')
combined_map.head()
```

Out[33]:

	Neighborhood	Lat	Lon	neighborhood	sale_price_sqr_foot	housing_units	gross_rent
0	Alamo Square	37.791012	-122.402100	Alamo Square	366.020712	378401.0	2817.285714
1	Anza Vista	37.779598	-122.443451	Anza Vista	373.382198	379050.0	3031.833333
2	Bayview	37.734670	-122.401060	Bayview	204.588623	376454.0	2318.400000
3	Bayview Heights	37.728740	-122.410980	Bayview Heights	590.792839	382295.0	3739.000000
4	Bernal Heights	37.728630	-122.443050	Bernal Heights	576.746488	379374.5	3080.333333

In [34]:
```
scatter_price = px.scatter_mapbox(combined_map,
                  lat='Lat',
                  lon='Lon',
                  color='Neighborhood',
                  size='sale_price_sqr_foot',
                  zoom=11,
                  title = 'average sale price per square foot in san francisco')
```

In [35]:
```
scatter_price
```

average sale price per square foot in san francisco

In [36]:
```
scatter_rent = px.scatter_mapbox(combined_map,
                  lat='Lat',
                  lon='Lon',
                  color='Neighborhood',
                  size='gross_rent',
                  zoom=11,
                  title = 'average rent price per square foot in san francisco')
```

In [37]:
```
scatter_rent
```

average rent price per square foot in san francisco

In [ ]:

In [38]:
```
# dashboard
```

In [ ]:

In [39]:
```
def get_price_per_sf():
    scatter_price
    return scatter_price


def get_rent_per_sf():
    scatter_rent
    return scatter_rent
```

In [40]:
```
sf_analysis = pn.Column(

    '#real estate analysis of san francisco from 2010 to 2016',
    housing_units_plots.get_figure(),
    gross_rents_plot.get_figure(),
    rent_plot.get_figure()

)
```

In [41]:
```
neighborhood_analysis = pn.Column(

    '#san francisco neighborhood real estate analysis',
    top_10,
    neighborhood_sales,
    neighborhood_rents,
    side_plot

)
```

In [42]:
```
price_rent = pn.Column(

    '#visual map of average neighborhood prices per square foot in san francisco',
    scatter_price,
    scatter_rent

)
```

In [43]:
```
dashboard = pn.Tabs(

    ('real estate prices', sf_analysis ),
    ('neighborhood analysis', neighborhood_analysis),
    ('price vs. rent', price_rent)

)
```

In [44]:
```
dashboard.servable()
```

Out[44]:

In [ ]:

In [45]:
```
# panel serve pyviz_homework_v1_dashboard.ipynb --log-level debug --show
```

In [ ]:

In [ ]:

In [ ]:

In [ ]:

In [ ]:

In [ ]:

In [ ]:

In [ ]: