In [1]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
%matplotlib inline
import plotly.graph_objects as go
import plotly.express as px
import seaborn as sns
```

In [2]:
```
file = pd.read_csv(r"E:\assignment\final\final19.csv")
```

In [3]:
```
file
```

Out[3]:

	Date	House_Price_Index	Interest_Rate	No_of_property_Introduced	PPI	Income	Unemployment	Working_Pop	
0	1/1/2003	128.461	1.24	1654	144.400	10710.4	5.8	185635346.4	182.
1	2/1/2003	129.355	1.26	1688	145.200	10674.0	5.9	185869692.3	183.
2	3/1/2003	130.148	1.25	1638	145.200	10696.5	5.9	186085118.2	183.
3	4/1/2003	130.884	1.26	1662	145.900	10752.7	6.0	186470754.0	183.
4	5/1/2003	131.735	1.26	1733	145.800	10832.0	6.1	186649078.0	182.
...	...	...	...	...	...	...	...	...	
235	8/1/2022	301.473	2.33	1355	342.753	16161.4	3.7	207370651.0	295.
236	9/1/2022	299.353	2.56	1438	336.464	16184.9	3.5	207453580.5	296.
237	10/1/2022	298.873	3.08	1348	333.796	16223.5	3.7	207431164.7	297.
238	11/1/2022	298.269	3.78	1543	330.369	16229.6	3.6	207521914.2	298.
239	12/1/2022	297.413	4.10	1390	326.449	16265.1	3.5	207524486.3	298.

240 rows × 26 columns

Data Preparation

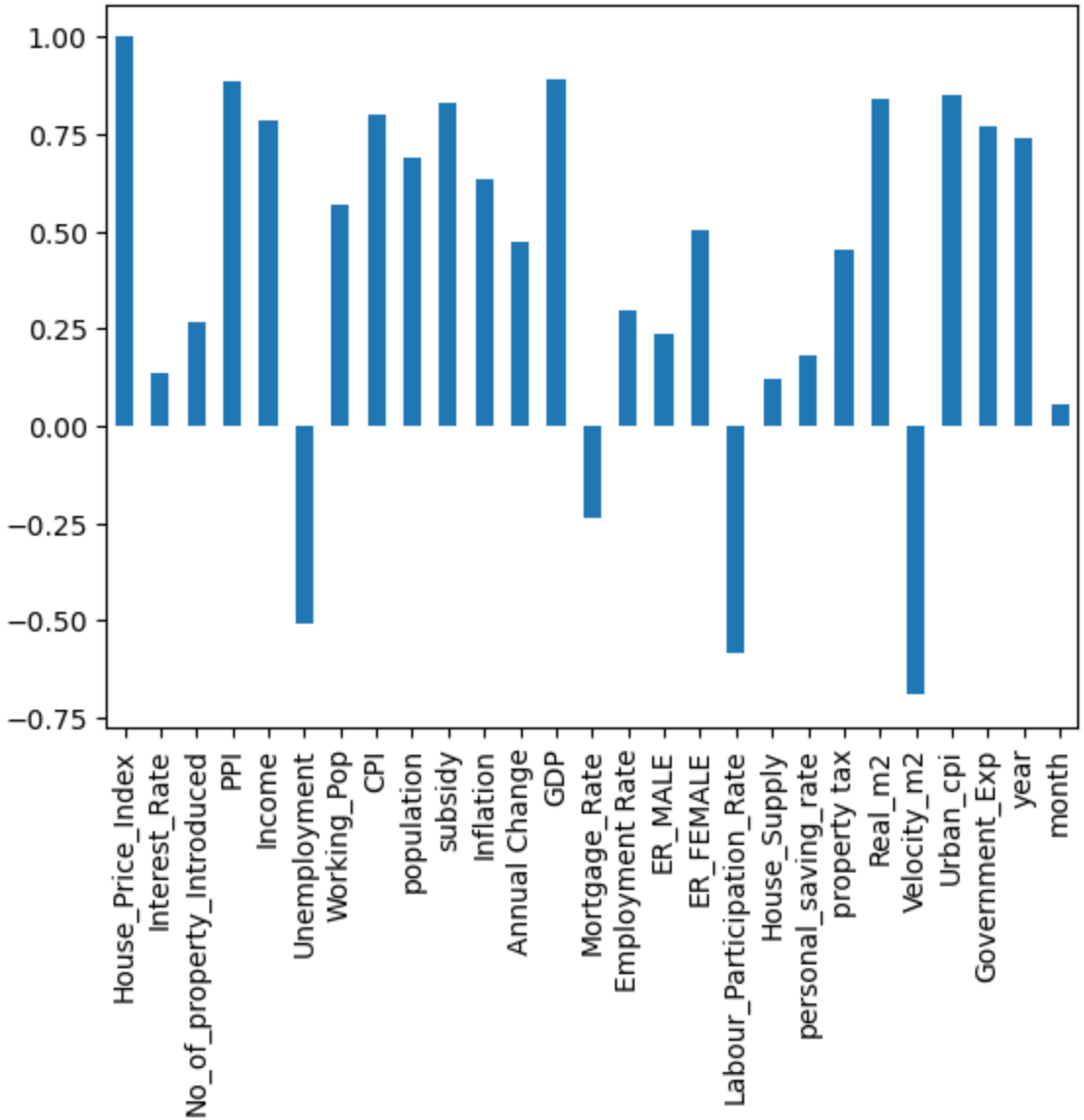
In [4]:
```
file['Date'] = pd.to_datetime(file['Date'])
file['year'] = file['Date'].dt.year
file['month'] = file['Date'].dt.month
```

correlation with Output column

In [6]:
```
file.corr()['House_Price_Index'].plot(kind='bar')
```

```
C:\Users\ravin\AppData\Local\Temp\ipykernel_5116\2590138823.py:1: FutureWarning: The default value of numeric_only in DataFrame.corr is deprecated. In a future version, it will default to False. Select only valid columns or specify the value of numeric_only to silence this warning.
  file.corr()['House_Price_Index'].plot(kind='bar')
```

Out[6]:
```
<Axes: >
```



In [ ]:

House_Price_Index vs Date

In [10]:
```
fig = go.Figure()

fig.add_trace(go.Scatter(x=file['year'], y=file['House_Price_Index'], mode='lines', name='House Price Ind

fig.update_layout(title='House Price Index Over Years',
                  xaxis=dict(title='Year'),
                  yaxis=dict(title='House Price Index'))

fig.show()
```

```
# there was rise in house price from 2004 to 2006
# dcline in house Price from 2007 upto 2012
# there was rise in house price index from 2013
# there was revolutionary change from 2020  and onword
```

In [ ]:

PPI vs House_Price_Index

In [11]:
```
fig = px.scatter(file, x='House_Price_Index', y='PPI', title='Scatter Plot: House Price Index vs. PPI')

fig.show()
```


```
#  The Producer Price Index by Commodity: Special Indexes: Construction Materials (PPI-CM) is a
statistical measure of the change in prices paid by producers for materials and components used in
construction
# there is sort of linear relationship between PPi and Price of Houses,if PPI increase then house prices
will increase as well
```

```
# in between 2008 to 2013,when PPI is high but house price index is low this is because of Great
Recession, this means for construction high expenses was incurred as compared to price charged from
customers
```

In [89]:

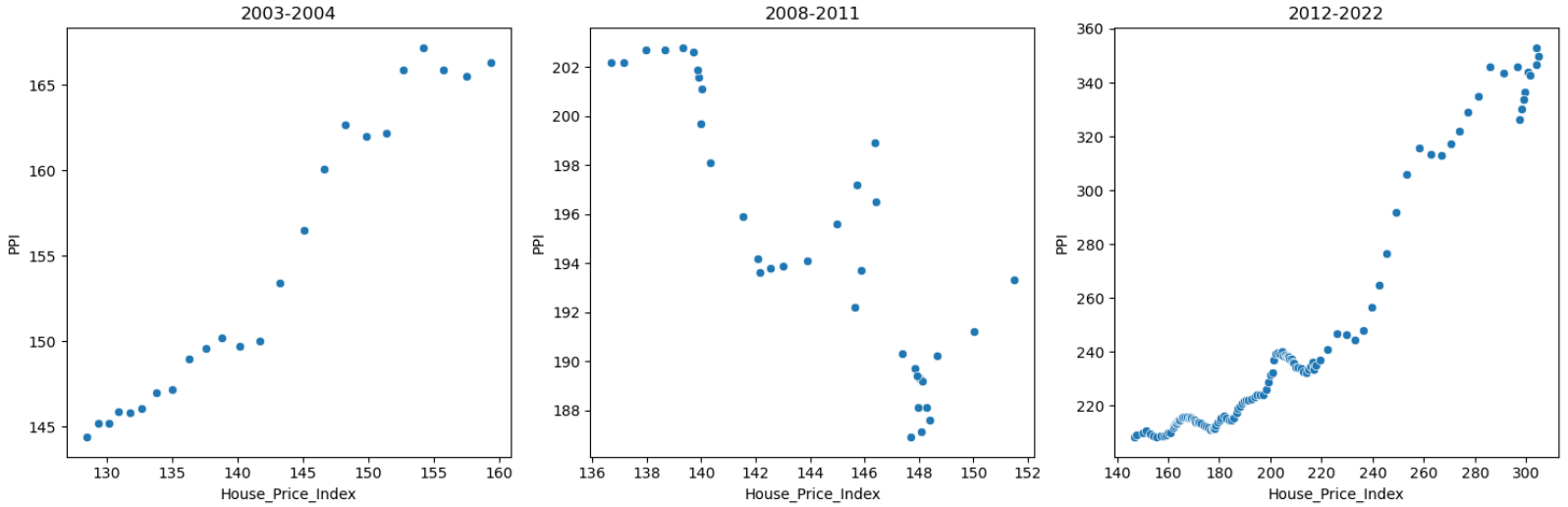
```
first = file[file['year'] < 2005]
first1 = file[(file['year'] > 2005) & (file['year'] <= 2008)]
second = file[(file['year'] > 2008) & (file['year'] <= 2011)]
event = file[(file['year'] >= 2011) & (file['year'] <= 2014)]
third = file[file['year'] > 2012]
fifth = third[third['year'] > 2019]
fourth = third[(third['year'] <= 2019) & (third['year'] > 2012)]
```

In [59]:

```
fig, axes = plt.subplots(nrows=1, ncols=3, figsize=(15, 5))

sns.scatterplot(data=first, x='House_Price_Index', y='PPI', ax=axes[0])
axes[0].set_title('2003-2004')

sns.scatterplot(data=second, x='House_Price_Index', y='PPI', ax=axes[1])
axes[1].set_title('2008-2011')
sns.scatterplot(data=third, x='House_Price_Index', y='PPI', ax=axes[2])
axes[2].set_title('2012-2022')
plt.tight_layout()
plt.show()
```



In [ ]:

```
# from 2003 to 2005, when there is rise in Producer Price Index and House Price Index, there is Linear relationship between PPI and House Price Index. it s contributing as well in consistent rise in House Price Index

# During 2008 and 2011, There is negtive relationship between House Price Index and Producer Price Index due to Great Recession
# as per above graph, economy is trying to recover from Recession

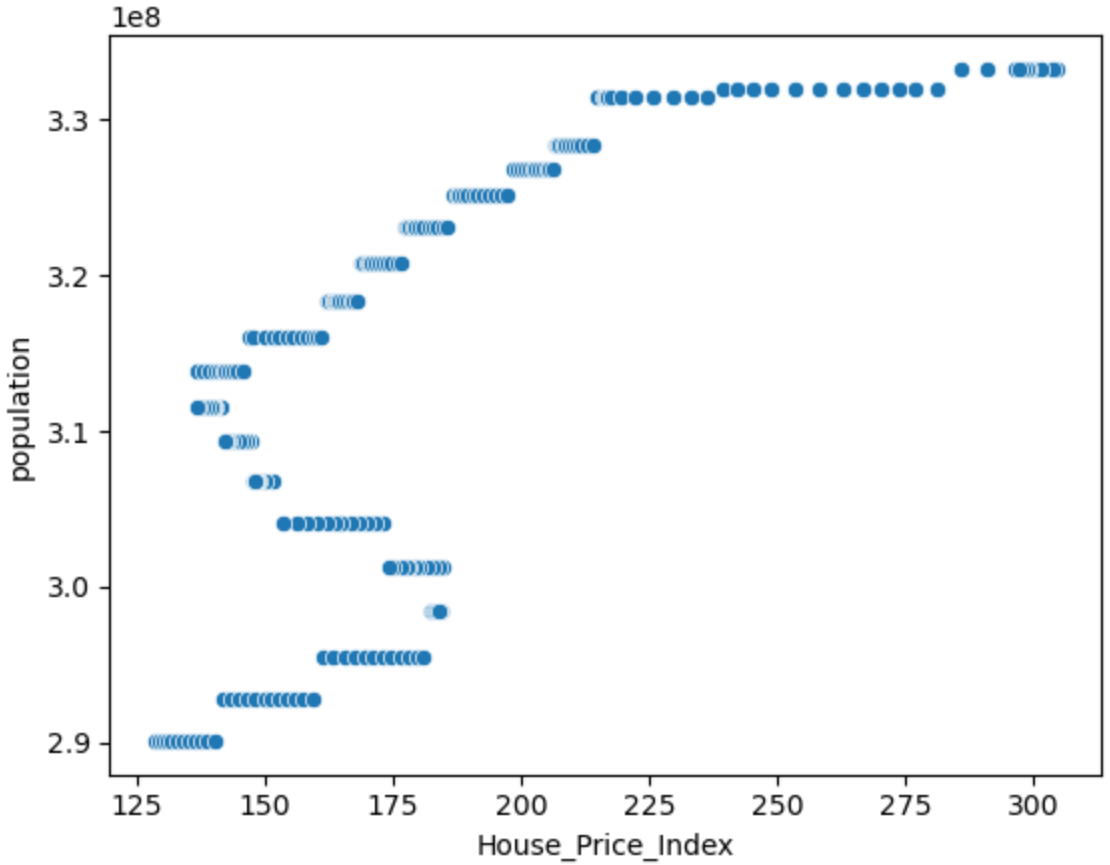
# Again PPI and House Price Index started lising Linearly from 2012
```

In [ ]:

population and working Population vs House_Price_Index

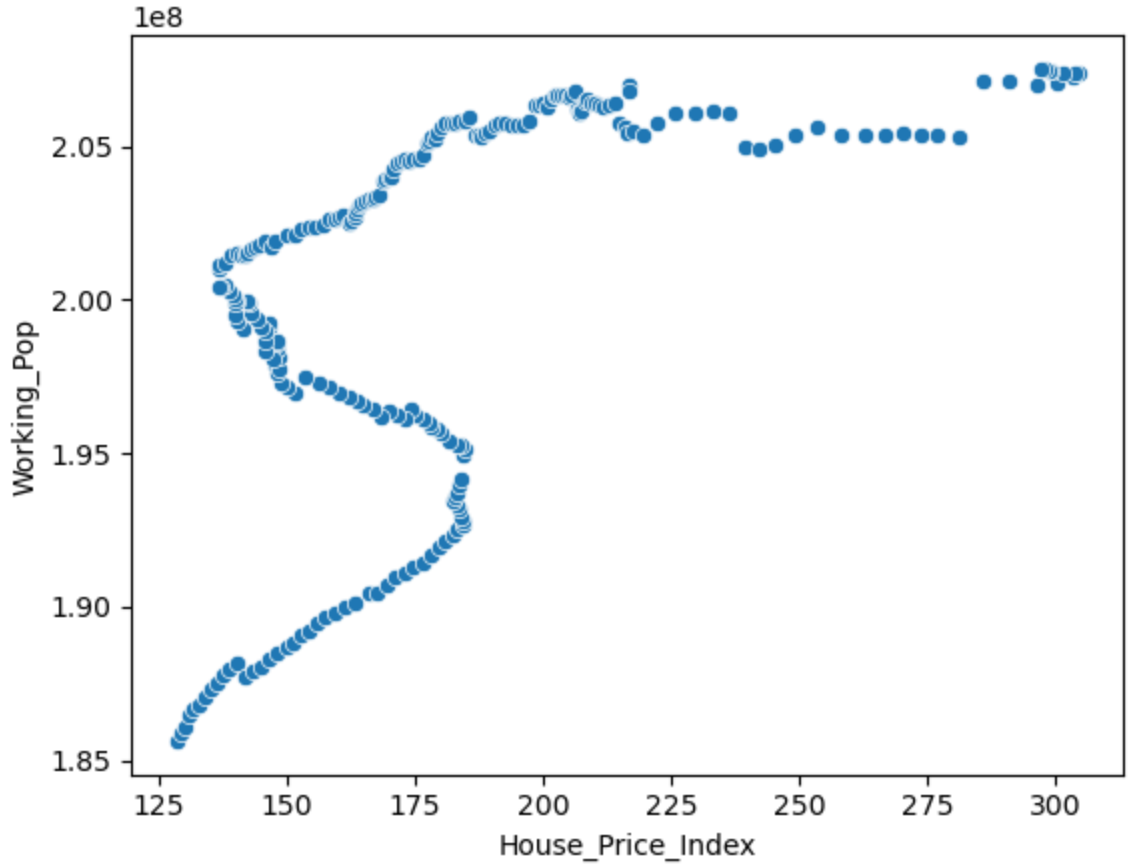
In [86]:
```
sns.scatterplot(data=file, y='population', x='House_Price_Index')
```

Out[86]: <Axes: xlabel='House_Price_Index', ylabel='population'>



In [95]:
```
sns.scatterplot(data=file, y='Working_Pop', x='House_Price_Index')
```

Out[95]: <Axes: xlabel='House_Price_Index', ylabel='Working_Pop'>




```
# as per above both graphs, as you can see when population is rising the house price index is rising as
well, but during 2008 to 2013 due to great recession house price index droped and then again started
rising
```

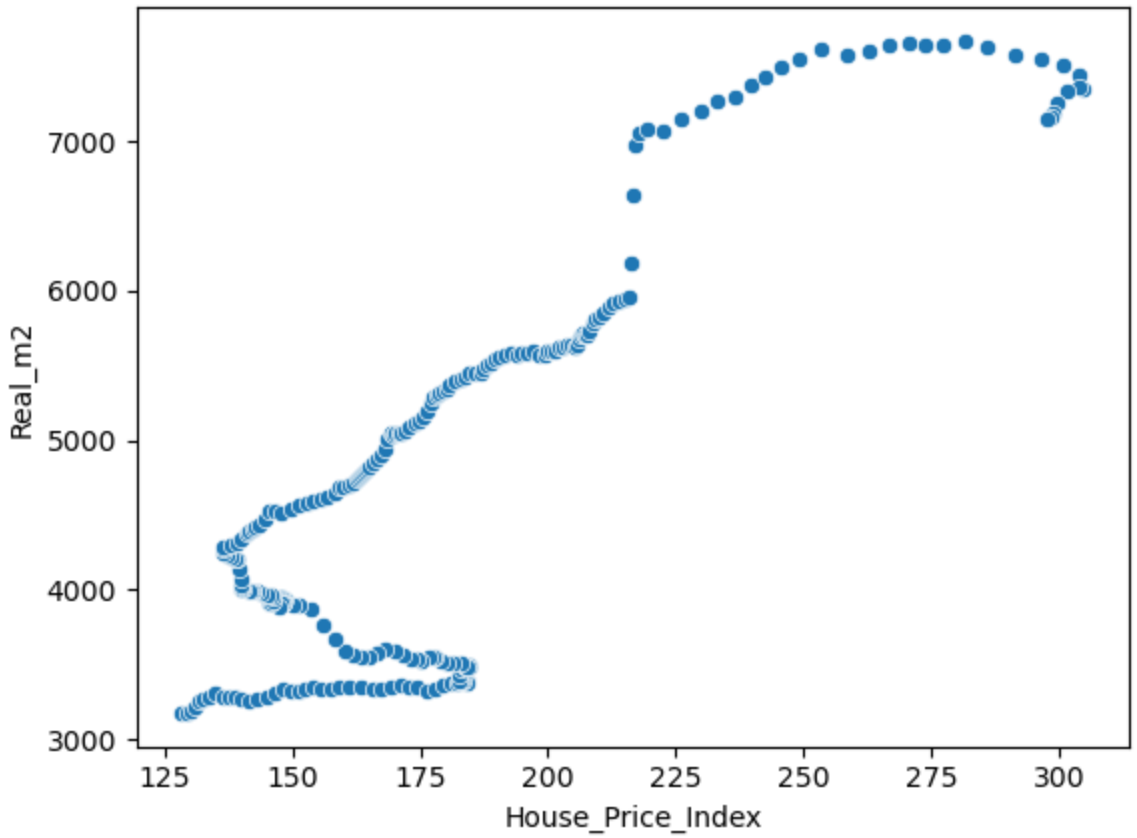
In [ ]:
```

```

Real_m2 vs House_Price_Index

In [107]:
```
sns.scatterplot(data=file, y='Real_m2', x='House_Price_Index')
```

Out[107]:
```
<Axes: xlabel='House_Price_Index', ylabel='Real_m2'>
```




```
# Real M2 and House Price Index, there is linear relationship between real M2 and House Price index,
affect of Great Recession can be seen in graph, otherwise there is clear linear relationship between Real
M2 and House Price Index
```

In [94]:

```
fig, axes = plt.subplots(nrows=2, ncols=3, figsize=(18, 8))


sns.scatterplot(data=first, x='House_Price_Index', y='Real_m2', ax=axes[0, 0])
axes[0, 0].set_title('2003-2004')


sns.scatterplot(data=first1, x='House_Price_Index', y='Real_m2', ax=axes[0, 1])
axes[0, 1].set_title('2005-2007')

sns.scatterplot(data=second, x='House_Price_Index', y='Real_m2', ax=axes[0, 2])
axes[0, 2].set_title('2008-2011')


sns.scatterplot(data=third, x='House_Price_Index', y='Real_m2', ax=axes[1, 0])
axes[1, 0].set_title('2012-2022')

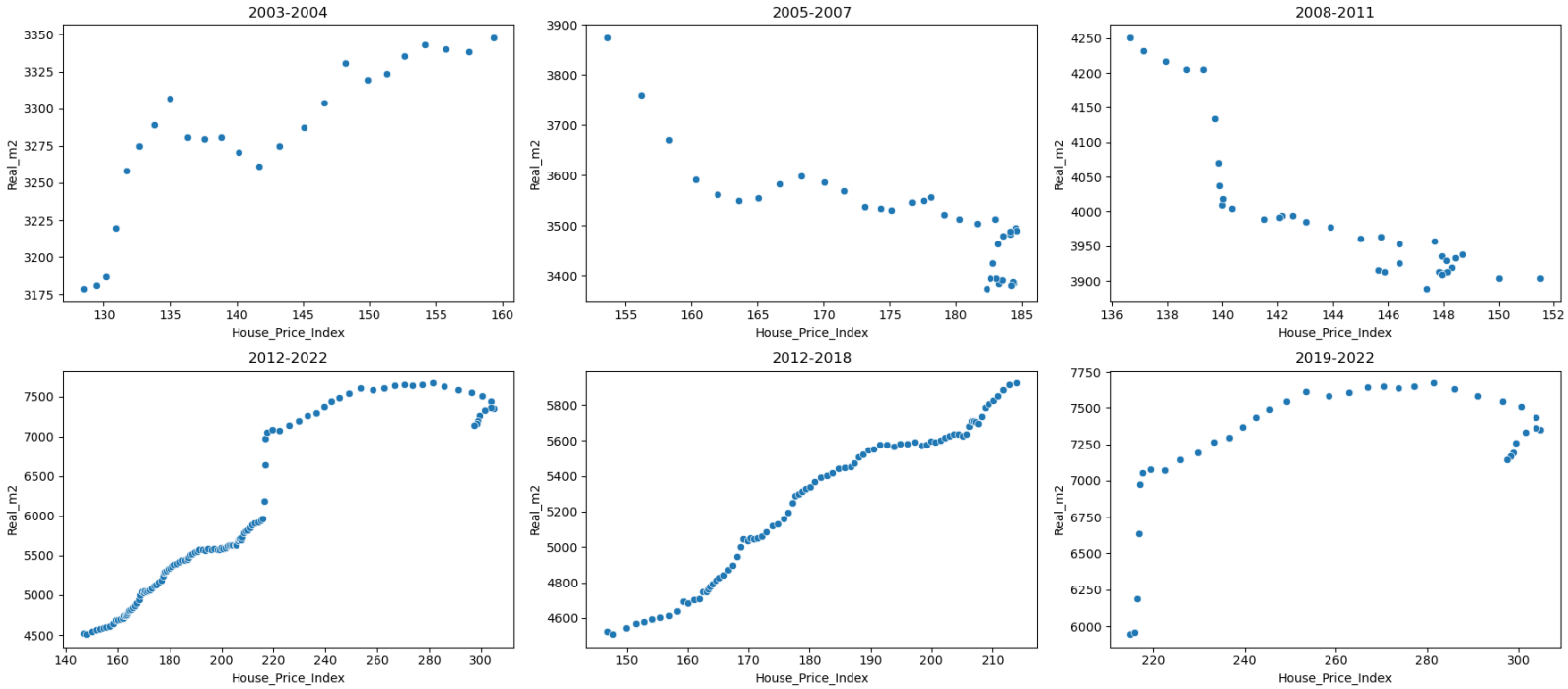
sns.scatterplot(data=fourth, x='House_Price_Index', y='Real_m2', ax=axes[1, 1])
axes[1, 1].set_title('2012-2018')

sns.scatterplot(data=fifth, x='House_Price_Index', y='Real_m2', ax=axes[1, 2])
axes[1, 2].set_title('2019-2022')



plt.tight_layout()

plt.show()
```




```
# When Real Money Stock is rising and House Price Index is rising as well
# in Between 2003 and 2005, there is aggresive increase in Real M2 but House Price is increasing at normal
rate in start

# During 2008- 2011, there is negtive Linear Relationship between Real M2 and House Price Index, Supply of
money after considering inflation is decreasing

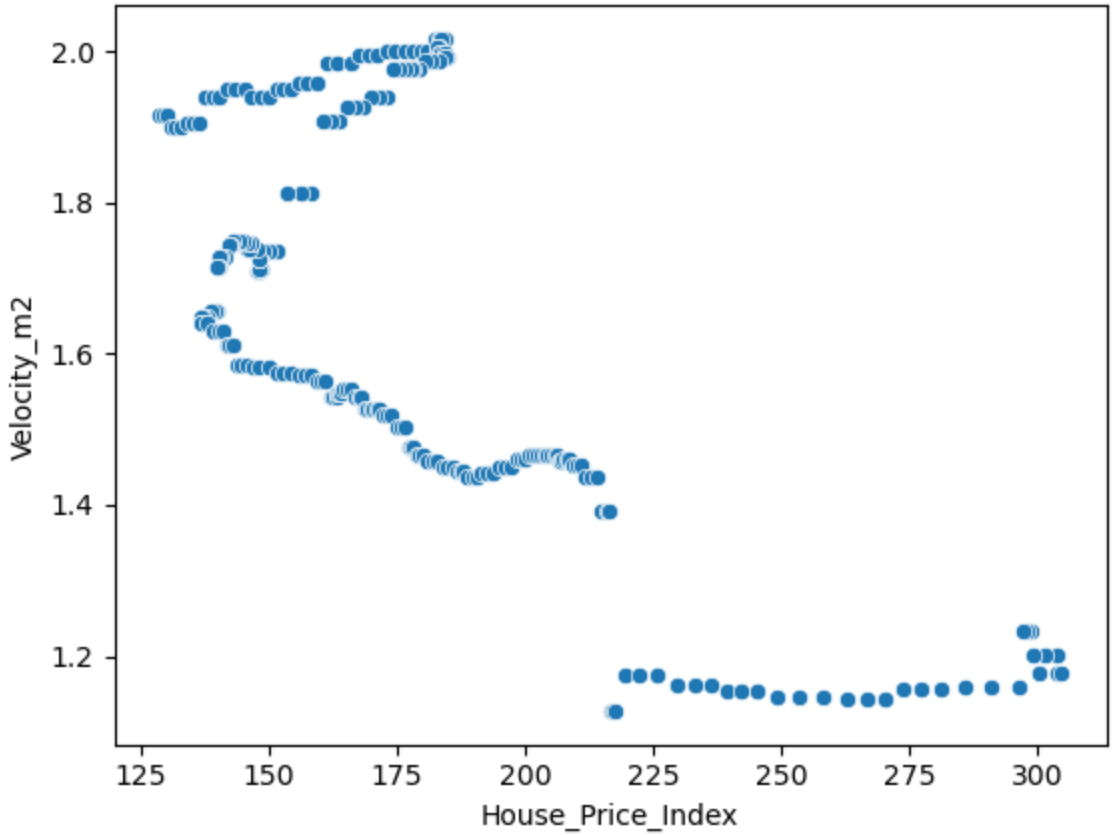
# During 2019 and 2022, there was drastic chnage in Real M2 and then increase in real m2 was normal
```

In [ ]:

Velocity_m2 vs House_Price_Index

In [85]:
```
sns.scatterplot(data=file, y='Velocity_m2', x='House_Price_Index')
```

Out[85]: <Axes: xlabel='House_Price_Index', ylabel='Velocity_m2'>




```
# there is negtive Linear relationship between House Price Index and Velocity M2 and affect of Great
Recession can be seen in graph
```

In [ ]:
```

```

In [95]:

```
fig, axes = plt.subplots(nrows=2, ncols=3, figsize=(18, 8))


sns.scatterplot(data=first, x='House_Price_Index', y='Velocity_m2', ax=axes[0, 0])
axes[0, 0].set_title('2003-2004')


sns.scatterplot(data=first1, x='House_Price_Index', y='Velocity_m2', ax=axes[0, 1])
axes[0, 1].set_title('2005-2007')

sns.scatterplot(data=second, x='House_Price_Index', y='Velocity_m2', ax=axes[0, 2])
axes[0, 2].set_title('2008-2011')


sns.scatterplot(data=third, x='House_Price_Index', y='Velocity_m2', ax=axes[1, 0])
axes[1, 0].set_title('2012-2022')

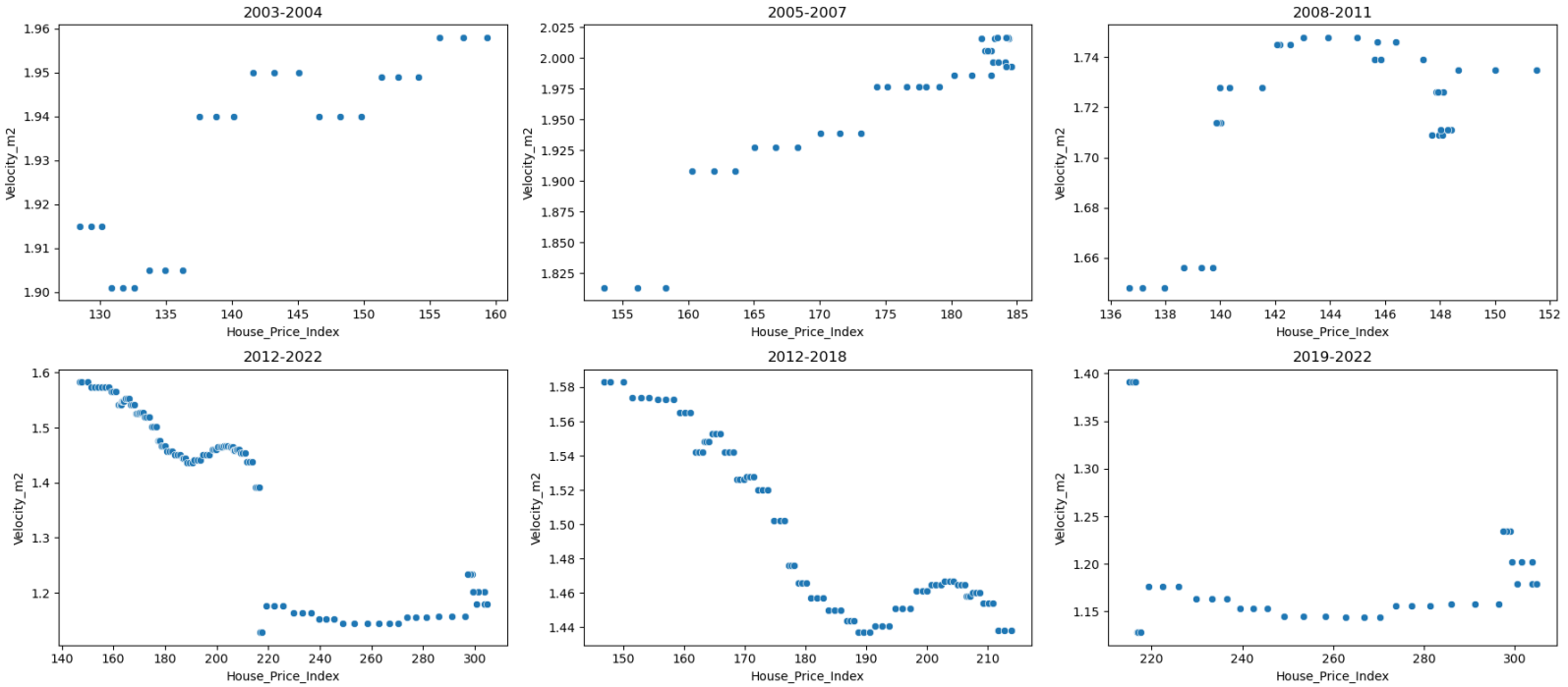
sns.scatterplot(data=fourth, x='House_Price_Index', y='Velocity_m2', ax=axes[1, 1])
axes[1, 1].set_title('2012-2018')

sns.scatterplot(data=fifth, x='House_Price_Index', y='Velocity_m2', ax=axes[1, 2])
axes[1, 2].set_title('2019-2022')



plt.tight_layout()

plt.show()
```



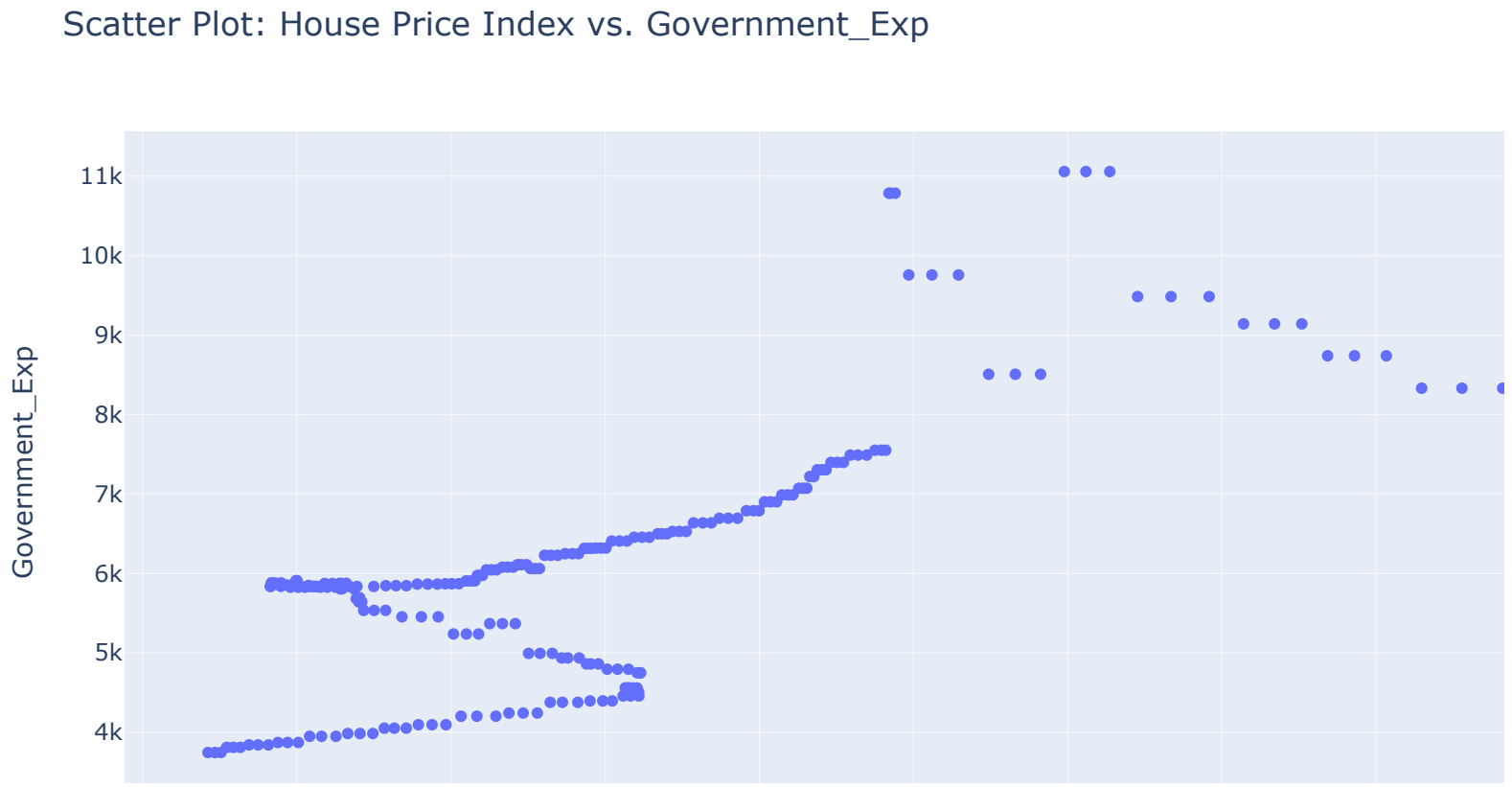
In [ ]:

In [ ]:

Government_Exp vs House_Price_Index

In [86]:
```
fig = px.scatter(file, x='House_Price_Index', y='Government_Exp', title='Scatter Plot: House Price Index

fig.show()
```



```
# there is sort of Linear relationship between House Price Index and Government, there affect of Great
Recession can be seen in graph
```

In [ ]:

In [96]:

```
fig, axes = plt.subplots(nrows=2, ncols=3, figsize=(18, 8))


sns.scatterplot(data=first, x='House_Price_Index', y='Government_Exp', ax=axes[0, 0])
axes[0, 0].set_title('2003-2004')


sns.scatterplot(data=first1, x='House_Price_Index', y='Government_Exp', ax=axes[0, 1])
axes[0, 1].set_title('2005-2007')

sns.scatterplot(data=second, x='House_Price_Index', y='Government_Exp', ax=axes[0, 2])
axes[0, 2].set_title('2008-2011')


sns.scatterplot(data=third, x='House_Price_Index', y='Government_Exp', ax=axes[1, 0])
axes[1, 0].set_title('2012-2022')

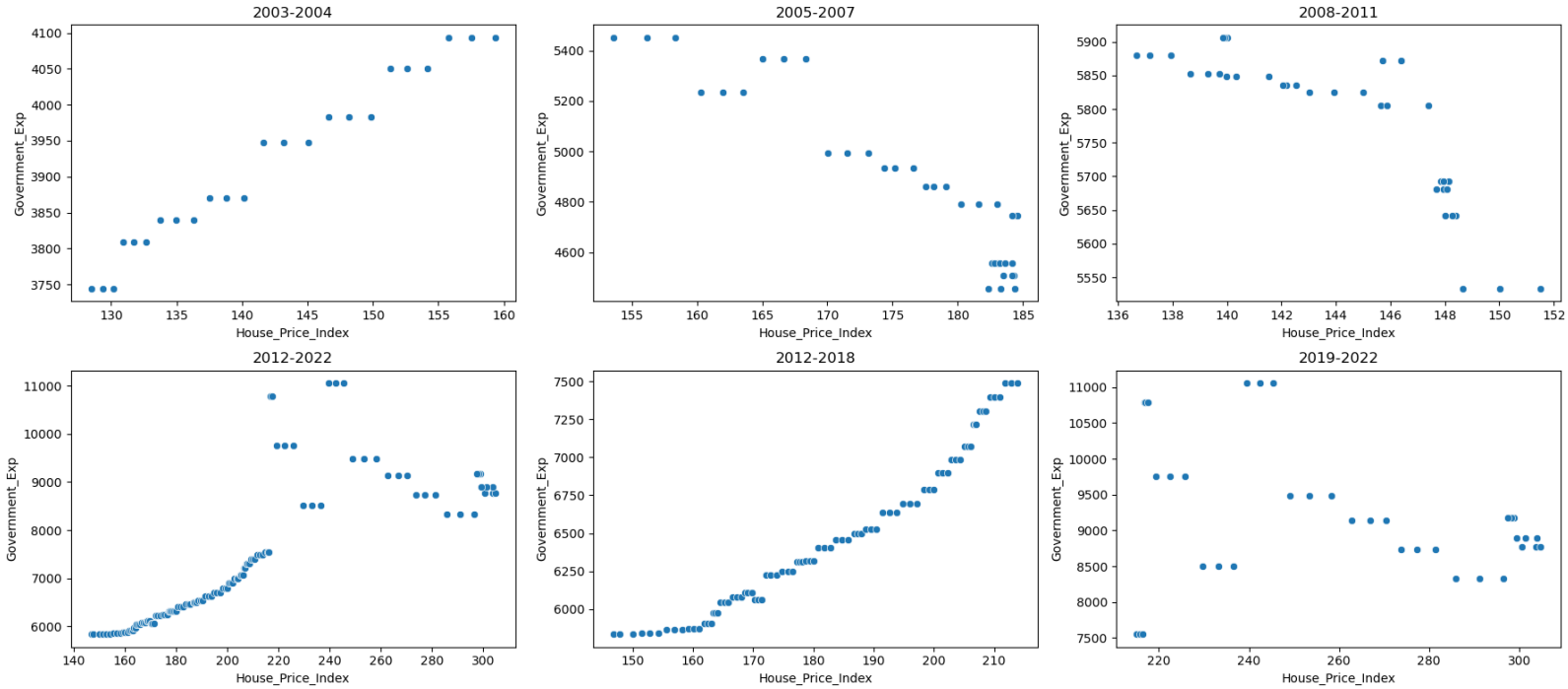
sns.scatterplot(data=fourth, x='House_Price_Index', y='Government_Exp', ax=axes[1, 1])
axes[1, 1].set_title('2012-2018')

sns.scatterplot(data=fifth, x='House_Price_Index', y='Government_Exp', ax=axes[1, 2])
axes[1, 2].set_title('2019-2022')



plt.tight_layout()

plt.show()
```




```
# During 2003 and 2005, there is linear relationship between House Price Index and Governement exp,
economy growth is normal
# During 2008 and 2011 and 2005 and 2007 , when there was situation of Great Recession, there was drop of
Government expensiture

# During 2012 - 2018, government incurred expenditure to revive the economy  from Recession as per
requirement
# during 2019 to 2022, which was period of covid, government incurred even high as compared to previous
records
```

In [ ]:

Urban_cpi vs House_Price_Index

In [97]:
```
fig = px.scatter(file, x='House_Price_Index', y='Urban_cpi', title='Scatter Plot: House Price Index vs. U

fig.show()
```

In [98]:

```
fig, axes = plt.subplots(nrows=2, ncols=3, figsize=(18, 8))


sns.scatterplot(data=first, x='House_Price_Index', y='Urban_cpi', ax=axes[0, 0])
axes[0, 0].set_title('2003-2004')


sns.scatterplot(data=first1, x='House_Price_Index', y='Urban_cpi', ax=axes[0, 1])
axes[0, 1].set_title('2005-2007')

sns.scatterplot(data=second, x='House_Price_Index', y='Urban_cpi', ax=axes[0, 2])
axes[0, 2].set_title('2008-2011')


sns.scatterplot(data=third, x='House_Price_Index', y='Urban_cpi', ax=axes[1, 0])
axes[1, 0].set_title('2012-2022')

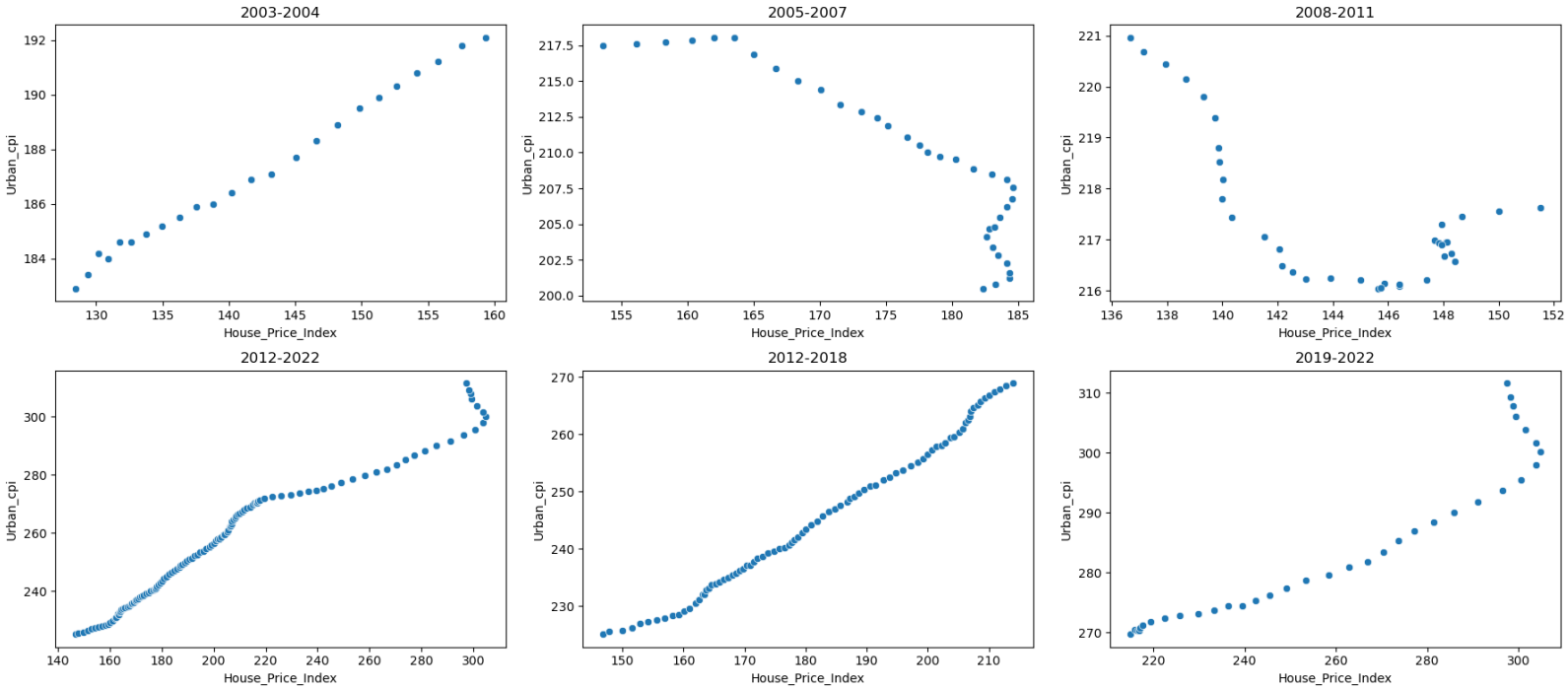
sns.scatterplot(data=fourth, x='House_Price_Index', y='Urban_cpi', ax=axes[1, 1])
axes[1, 1].set_title('2012-2018')

sns.scatterplot(data=fifth, x='House_Price_Index', y='Urban_cpi', ax=axes[1, 2])
axes[1, 2].set_title('2019-2022')



plt.tight_layout()

plt.show()
```




```
# There is Linear relationship between Urban_cpi and House Price Index, also the affect of Great Recession
can be seen in graph

# During 2005-2007 and 2008-2011, When there was Great Recession, drop of Urban Consumer Price Index and
House Price Index can be seen

# During 2012-2018, consistent rise in urban consumer price index and House Price Index can be seen when
economy started Recovering from Great Recession

# During 2021 and 2022, there was drastic change in Consumer Price Index, this could be due to end of
lockdown due to covid
```

In [ ]:

Income vs House_Price_Index

In [99]:
```
fig = px.scatter(file, x='House_Price_Index', y='Income', title='Scatter Plot: House Price Index vs. Incc

fig.show()
```


```
# Income vs House Price Index
# there is sort of Linear Relationship Between Income and House Price Index, it contains some Outliers
# also the affect of Great Recession can be seen
# if income will increase then demand of houses will increase too which will lead to high price index, if
supply of house is not enough to meet demand
```

```
# income does not contribute much in increasing the House Price Index
```

In [100]:

```
fig, axes = plt.subplots(nrows=2, ncols=3, figsize=(18, 8))


sns.scatterplot(data=first, x='House_Price_Index', y='Income', ax=axes[0, 0])
axes[0, 0].set_title('2003-2004')


sns.scatterplot(data=first1, x='House_Price_Index', y='Income', ax=axes[0, 1])
axes[0, 1].set_title('2005-2007')

sns.scatterplot(data=second, x='House_Price_Index', y='Income', ax=axes[0, 2])
axes[0, 2].set_title('2008-2011')


sns.scatterplot(data=third, x='House_Price_Index', y='Income', ax=axes[1, 0])
axes[1, 0].set_title('2012-2022')

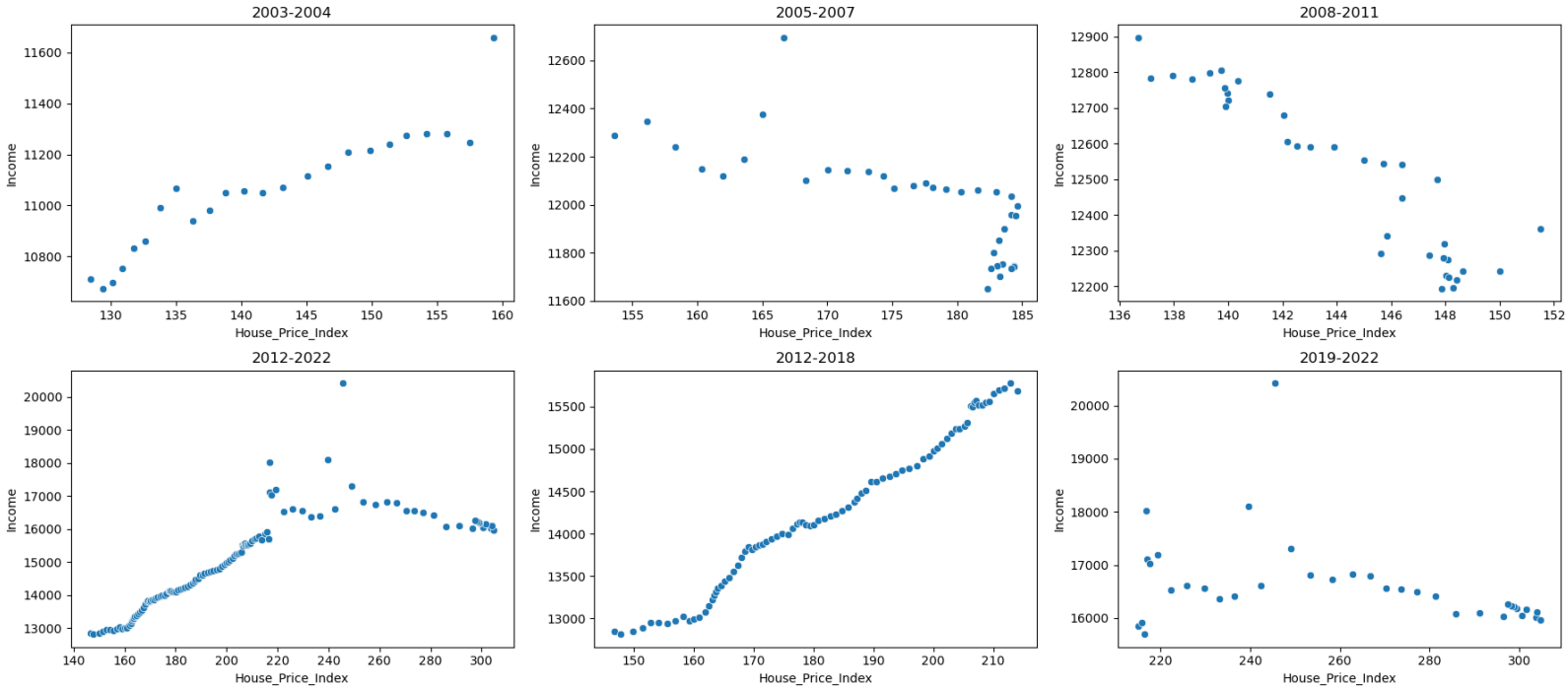
sns.scatterplot(data=fourth, x='House_Price_Index', y='Income', ax=axes[1, 1])
axes[1, 1].set_title('2012-2018')

sns.scatterplot(data=fifth, x='House_Price_Index', y='Income', ax=axes[1, 2])
axes[1, 2].set_title('2019-2022')



plt.tight_layout()

plt.show()
```



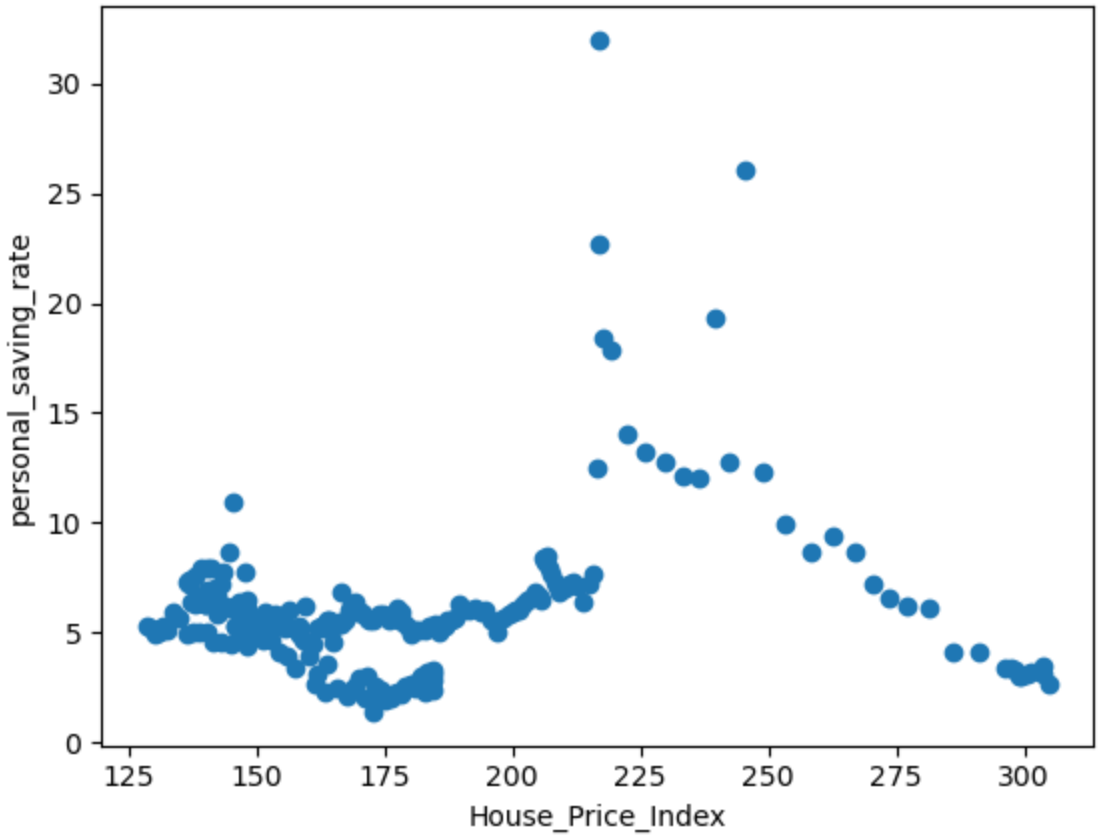

```
# There are Two siuation first is of Great Recession and and Covid
# During 2005-2007 and 2008-2011, there was situation of Great Recession, reduction can be seen in income level and House Price Index
# During the 2019-2022, small drop can be seen in House Price Index and Income Level
```

In [ ]:

personal_saving_rate vs House Price Index

In [121]:
```
plt.scatter(file['House_Price_Index'], file['personal_saving_rate'])
plt.xlabel('House_Price_Index')
plt.ylabel('personal_saving_rate')
```

Out[121]:
```
Text(0, 0.5, 'personal_saving_rate')
```



In [101]:

```
fig, axes = plt.subplots(nrows=2, ncols=3, figsize=(18, 8))


sns.scatterplot(data=first, x='House_Price_Index', y='personal_saving_rate', ax=axes[0, 0])
axes[0, 0].set_title('2003-2004')


sns.scatterplot(data=first1, x='House_Price_Index', y='personal_saving_rate', ax=axes[0, 1])
axes[0, 1].set_title('2005-2007')

sns.scatterplot(data=second, x='House_Price_Index', y='personal_saving_rate', ax=axes[0, 2])
axes[0, 2].set_title('2008-2011')


sns.scatterplot(data=third, x='House_Price_Index', y='personal_saving_rate', ax=axes[1, 0])
axes[1, 0].set_title('2012-2022')

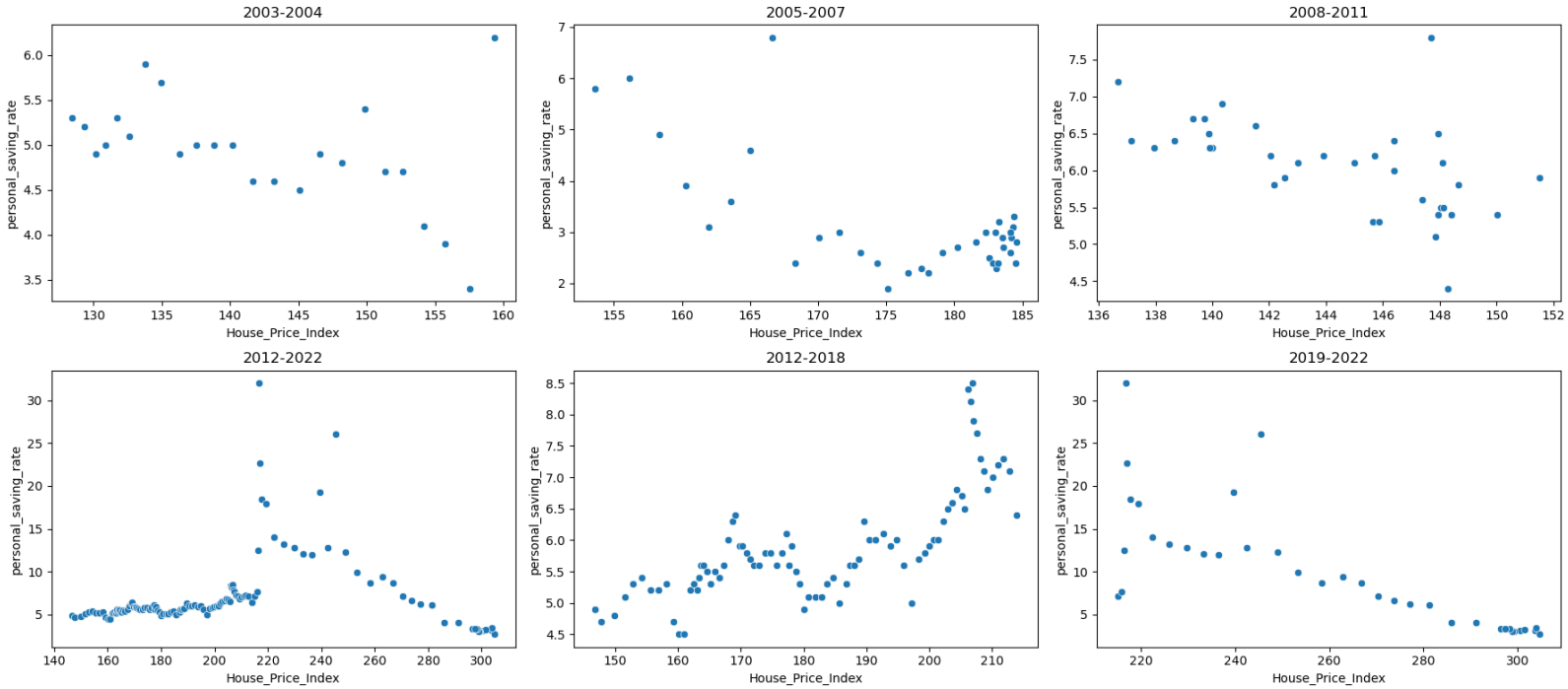
sns.scatterplot(data=fourth, x='House_Price_Index', y='personal_saving_rate', ax=axes[1, 1])
axes[1, 1].set_title('2012-2018')

sns.scatterplot(data=fifth, x='House_Price_Index', y='personal_saving_rate', ax=axes[1, 2])
axes[1, 2].set_title('2019-2022')



plt.tight_layout()

plt.show()
```

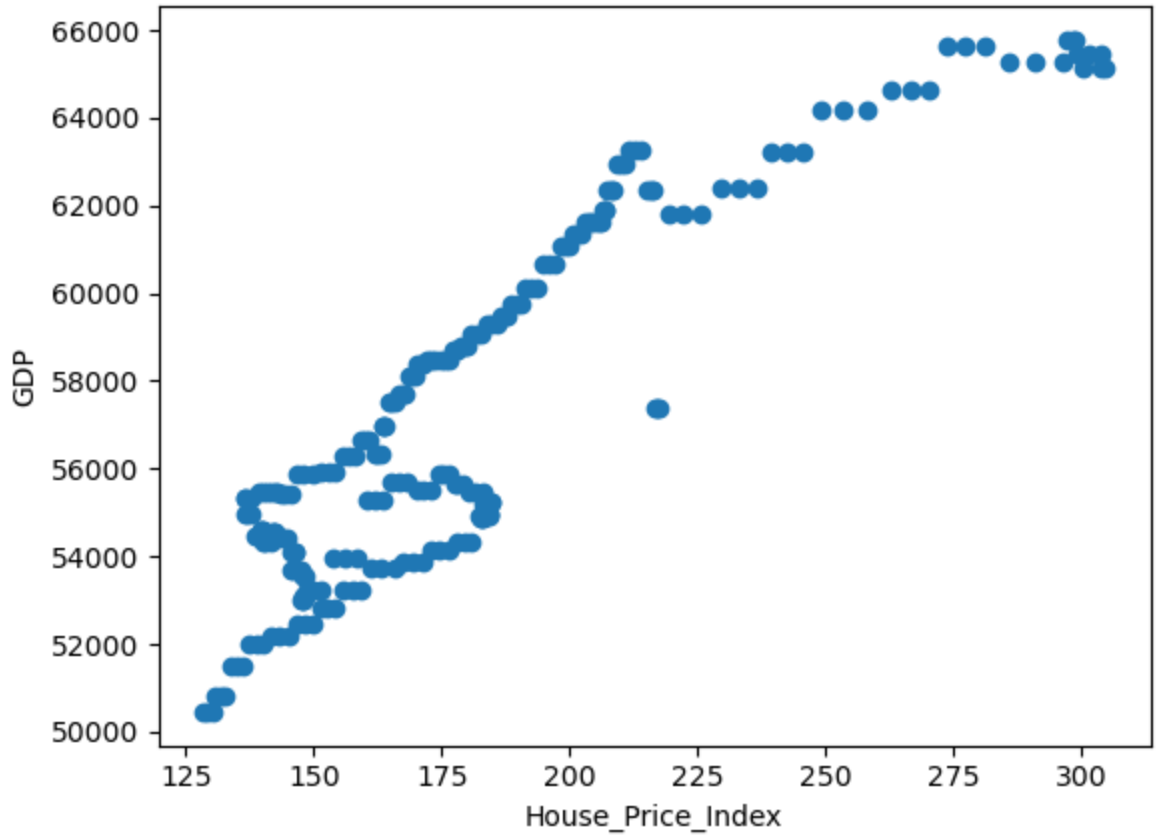


In [ ]:

GDP vs House Price Index

In [122]:
```
plt.scatter(file['House_Price_Index'], file['GDP'])
plt.xlabel('House_Price_Index')
plt.ylabel('GDP')
```

Out[122]: Text(0, 0.5, 'GDP')




```
# GDP vs House Price Index
# There is Linear relationship between GDP and House Price Index, when GDp increase then House Price Index
will incease as well
```

In [102]:

```
fig, axes = plt.subplots(nrows=2, ncols=3, figsize=(18, 8))


sns.scatterplot(data=first, x='House_Price_Index', y='GDP', ax=axes[0, 0])
axes[0, 0].set_title('2003-2004')


sns.scatterplot(data=first1, x='House_Price_Index', y='GDP', ax=axes[0, 1])
axes[0, 1].set_title('2005-2007')

sns.scatterplot(data=second, x='House_Price_Index', y='GDP', ax=axes[0, 2])
axes[0, 2].set_title('2008-2011')


sns.scatterplot(data=third, x='House_Price_Index', y='GDP', ax=axes[1, 0])
axes[1, 0].set_title('2012-2022')

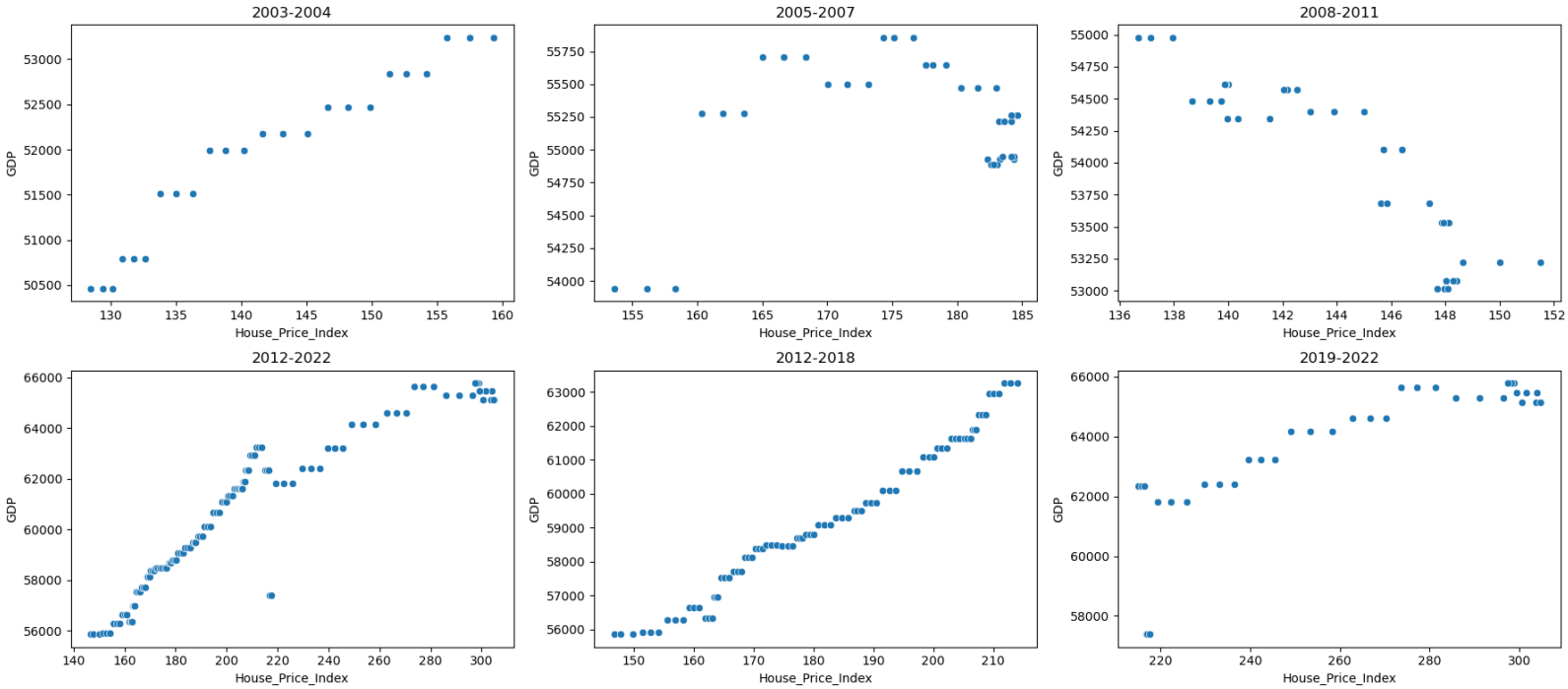
sns.scatterplot(data=fourth, x='House_Price_Index', y='GDP', ax=axes[1, 1])
axes[1, 1].set_title('2012-2018')

sns.scatterplot(data=fifth, x='House_Price_Index', y='GDP', ax=axes[1, 2])
axes[1, 2].set_title('2019-2022')



plt.tight_layout()

plt.show()
```



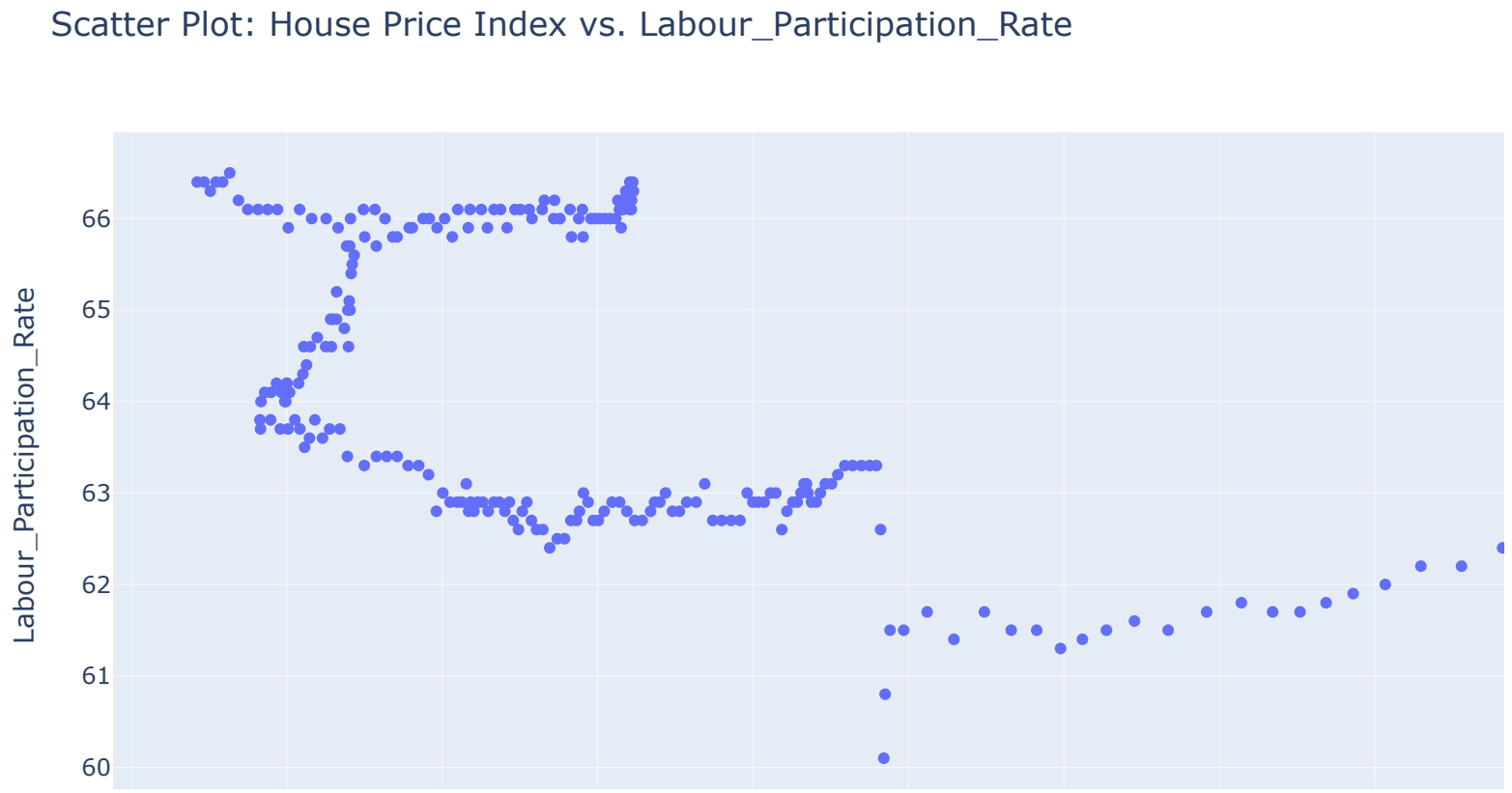

```
# if we do not consider the situation of covid and Great Recession, there was linear relationship between
GDP and House Price Index
# During 2008 and 2011, there was drop in GDP and House Price Index due to Great Recession
# During 2019-2022, there was drop in gdp during COVID but after slowly is started to reach on top
```

In [ ]:

Labour_Participation_Rate vs House Price index

In [103]:
```
fig = px.scatter(file, x='House_Price_Index', y='Labour_Participation_Rate', title='Scatter Plot: House P

fig.show()
```



In [107]:

```
fig, axes = plt.subplots(nrows=2, ncols=3, figsize=(18, 8))


sns.scatterplot(data=first, x='House_Price_Index', y='Labour_Participation_Rate', ax=axes[0, 0])
axes[0, 0].set_title('2003-2004')


sns.scatterplot(data=first1, x='House_Price_Index', y='Labour_Participation_Rate', ax=axes[0, 1])
axes[0, 1].set_title('2005-2007')

sns.scatterplot(data=second, x='House_Price_Index', y='Labour_Participation_Rate', ax=axes[0, 2])
axes[0, 2].set_title('2008-2011')


sns.scatterplot(data=third, x='House_Price_Index', y='Labour_Participation_Rate', ax=axes[1, 0])
axes[1, 0].set_title('2012-2022')

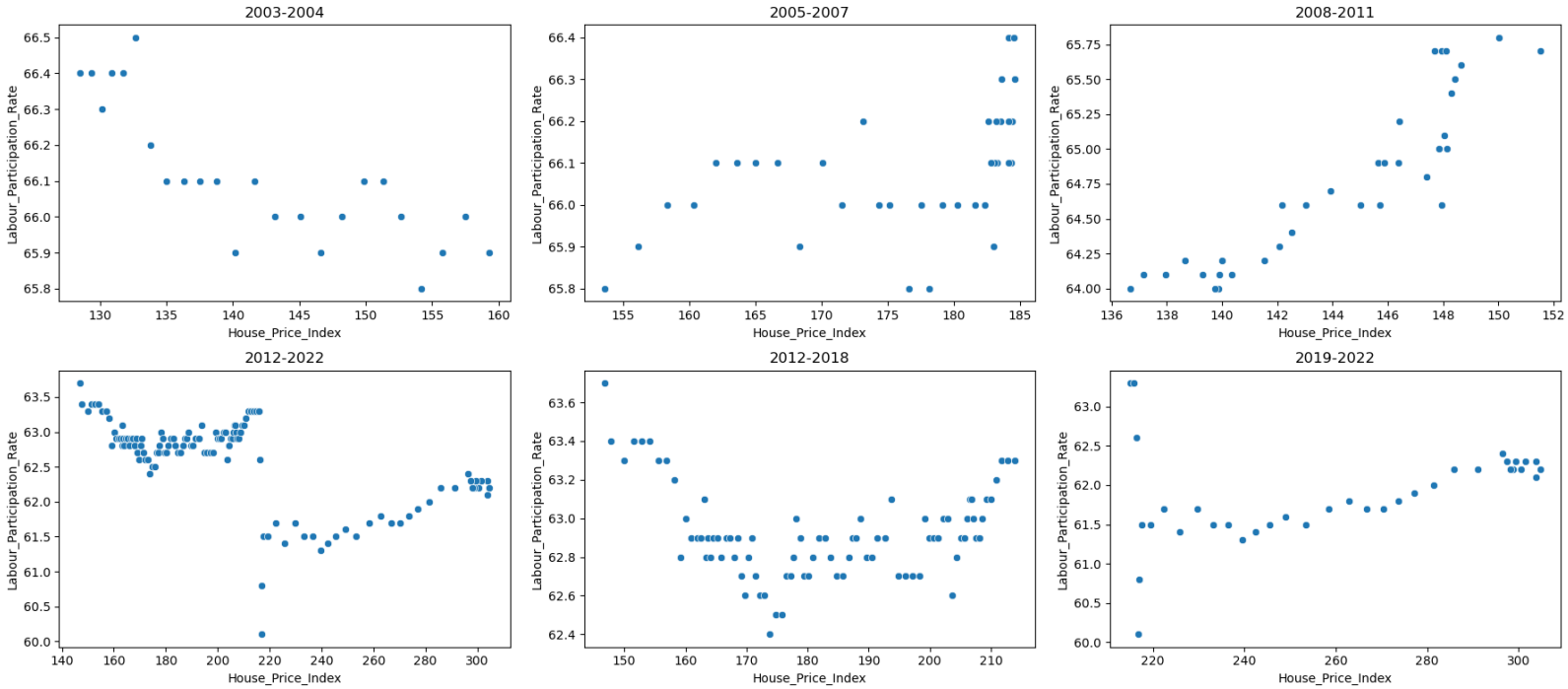
sns.scatterplot(data=fourth, x='House_Price_Index', y='Labour_Participation_Rate', ax=axes[1, 1])
axes[1, 1].set_title('2012-2018')

sns.scatterplot(data=fifth, x='House_Price_Index', y='Labour_Participation_Rate', ax=axes[1, 2])
axes[1, 2].set_title('2019-2022')



plt.tight_layout()

plt.show()
```



In [ ]:

CPI vs House Price Index

In [104]:
```
fig = px.scatter(file, x='House_Price_Index', y='CPI', title='Scatter Plot: House Price Index vs. CPI')

fig.show()
```

In [108]:

```
fig, axes = plt.subplots(nrows=2, ncols=3, figsize=(18, 8))


sns.scatterplot(data=first, x='House_Price_Index', y='CPI', ax=axes[0, 0])
axes[0, 0].set_title('2003-2004')


sns.scatterplot(data=first1, x='House_Price_Index', y='CPI', ax=axes[0, 1])
axes[0, 1].set_title('2005-2007')

sns.scatterplot(data=second, x='House_Price_Index', y='CPI', ax=axes[0, 2])
axes[0, 2].set_title('2008-2011')


sns.scatterplot(data=third, x='House_Price_Index', y='CPI', ax=axes[1, 0])
axes[1, 0].set_title('2012-2022')

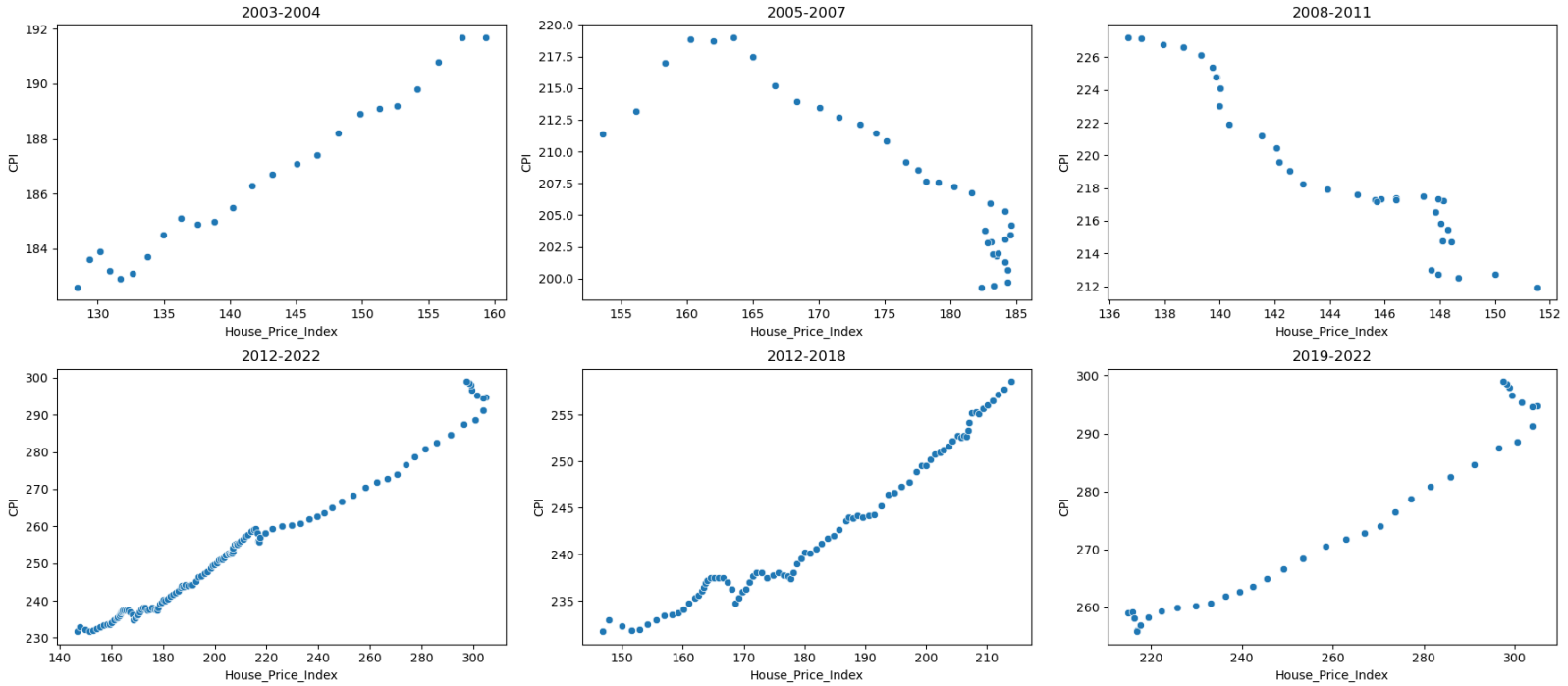
sns.scatterplot(data=fourth, x='House_Price_Index', y='CPI', ax=axes[1, 1])
axes[1, 1].set_title('2012-2018')

sns.scatterplot(data=fifth, x='House_Price_Index', y='CPI', ax=axes[1, 2])
axes[1, 2].set_title('2019-2022')



plt.tight_layout()

plt.show()
```




```
# it is same as urban cpi, during Great Recession there was decrese in CPI
# there was little drop in CPI during COVID
```

Mortgage_Rate/Interest_Rate vs House Price Index

In [105]:
```
fig = px.scatter(file, x='House_Price_Index', y='Mortgage_Rate', title='Scatter Plot: House Price Index v

fig.show()
```

In [106]:
```
fig = px.scatter(file, x='House_Price_Index', y='Interest_Rate', title='Scatter Plot: House Price Index v

fig.show()
```

In [ ]:
```

```

In [109]:

```
fig, axes = plt.subplots(nrows=2, ncols=3, figsize=(18, 8))


sns.scatterplot(data=first, x='House_Price_Index', y='Mortgage_Rate', ax=axes[0, 0])
axes[0, 0].set_title('2003-2004')


sns.scatterplot(data=first1, x='House_Price_Index', y='Mortgage_Rate', ax=axes[0, 1])
axes[0, 1].set_title('2005-2007')

sns.scatterplot(data=second, x='House_Price_Index', y='Mortgage_Rate', ax=axes[0, 2])
axes[0, 2].set_title('2008-2011')


sns.scatterplot(data=third, x='House_Price_Index', y='Mortgage_Rate', ax=axes[1, 0])
axes[1, 0].set_title('2012-2022')

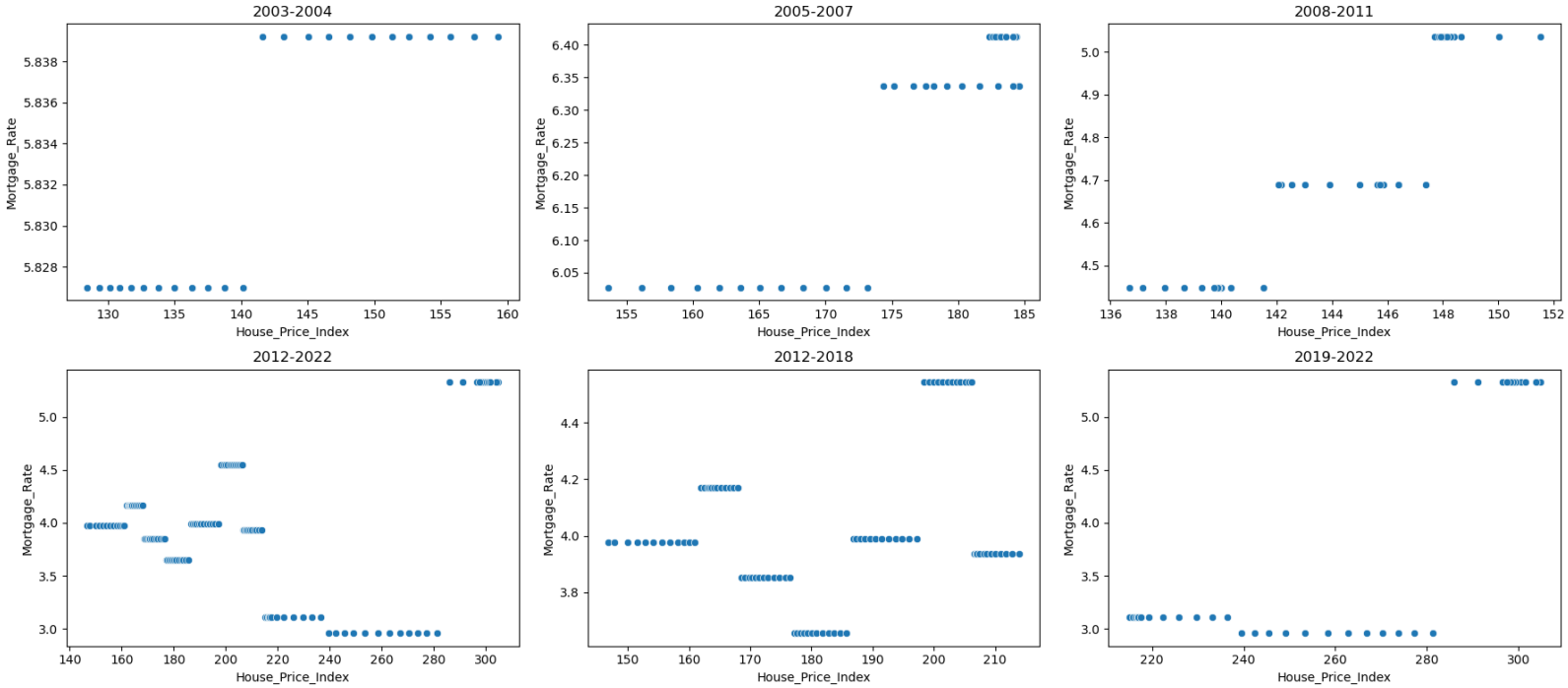
sns.scatterplot(data=fourth, x='House_Price_Index', y='Mortgage_Rate', ax=axes[1, 1])
axes[1, 1].set_title('2012-2018')

sns.scatterplot(data=fifth, x='House_Price_Index', y='Mortgage_Rate', ax=axes[1, 2])
axes[1, 2].set_title('2019-2022')



plt.tight_layout()

plt.show()
```


2003-2004
Mortgage_Rate
House_Price_Index
2005-2007
Mortgage_Rate
House_Price_Index
2008-2011
Mortgage_Rate
House_Price_Index
2012-2022
Mortgage_Rate
House_Price_Index
2012-2018
Mortgage_Rate
House_Price_Index
2019-2022
Mortgage_Rate
House_Price_Index

In [110]:

```
fig, axes = plt.subplots(nrows=2, ncols=3, figsize=(18, 8))


sns.scatterplot(data=first, x='House_Price_Index', y='Interest_Rate', ax=axes[0, 0])
axes[0, 0].set_title('2003-2004')


sns.scatterplot(data=first1, x='House_Price_Index', y='Interest_Rate', ax=axes[0, 1])
axes[0, 1].set_title('2005-2007')

sns.scatterplot(data=second, x='House_Price_Index', y='Interest_Rate', ax=axes[0, 2])
axes[0, 2].set_title('2008-2011')


sns.scatterplot(data=third, x='House_Price_Index', y='Interest_Rate', ax=axes[1, 0])
axes[1, 0].set_title('2012-2022')

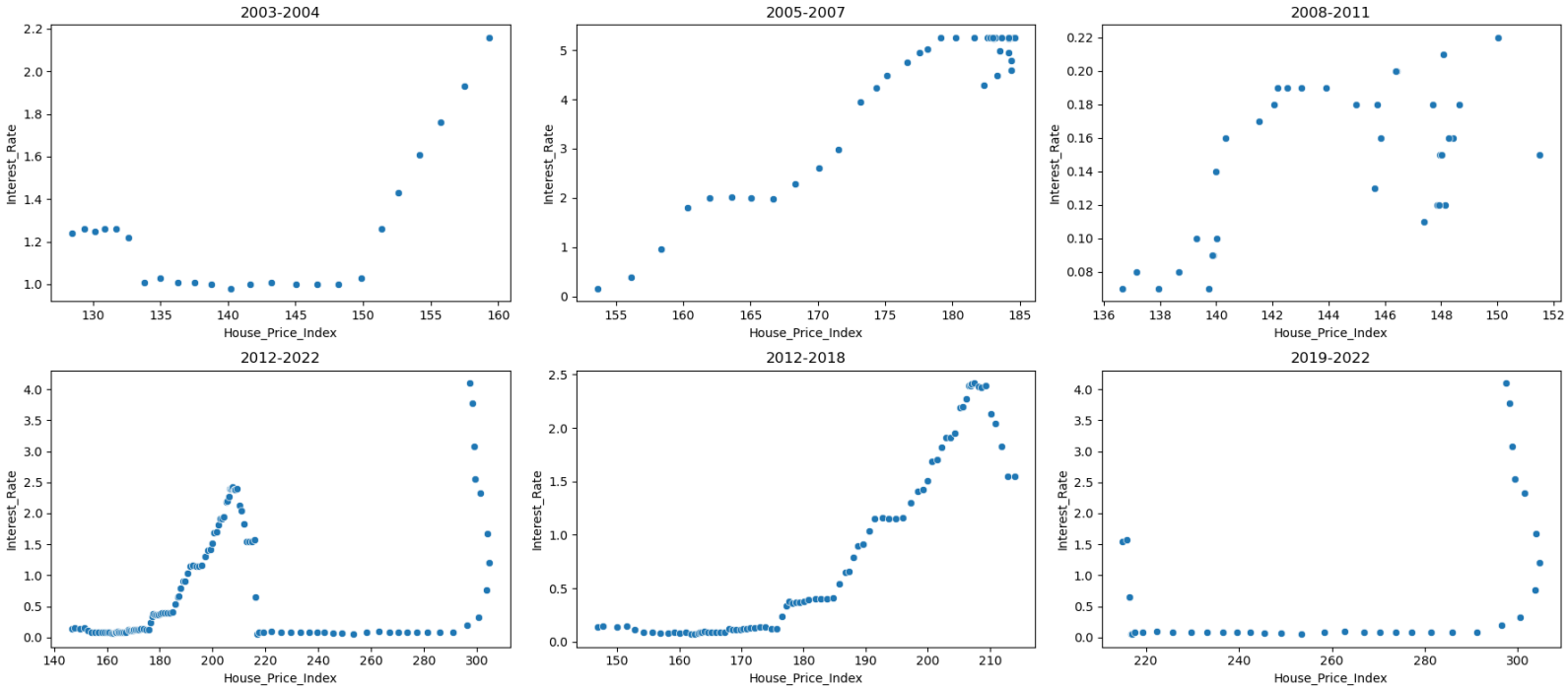
sns.scatterplot(data=fourth, x='House_Price_Index', y='Interest_Rate', ax=axes[1, 1])
axes[1, 1].set_title('2012-2018')

sns.scatterplot(data=fifth, x='House_Price_Index', y='Interest_Rate', ax=axes[1, 2])
axes[1, 2].set_title('2019-2022')



plt.tight_layout()

plt.show()
```




```
# it is effective interest rate which is charged by central bank from other bank banks for lending

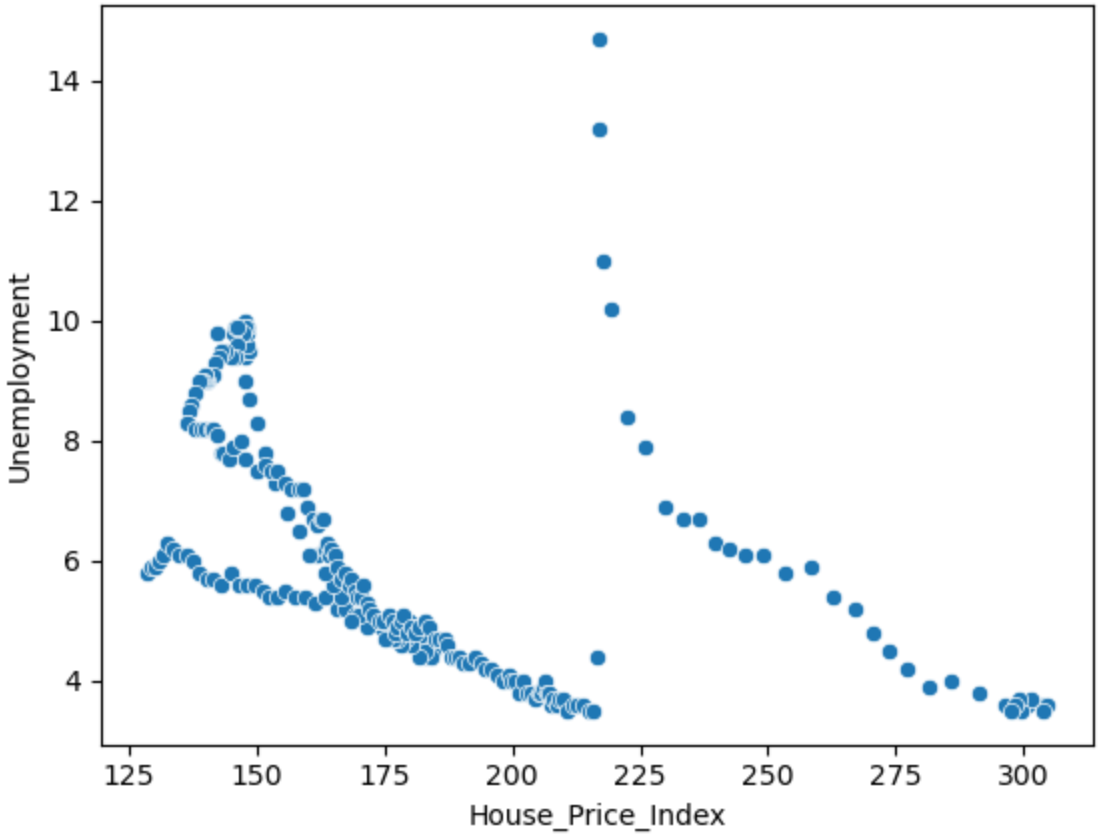
# when there was situation of Great Recession and COVID, Effective Interest rate increased,
# During 2019-2021, there was drop of economic activities, requirement of funds droped as well, this led
to the lower efective interest rate
```

In [ ]:

Unemployment vs House Price Index

In [139]:
```
sns.scatterplot(data=file, y='Unemployment', x='House_Price_Index')
```

Out[139]: <Axes: xlabel='House_Price_Index', ylabel='Unemployment'>



In [111]:

```
fig, axes = plt.subplots(nrows=2, ncols=3, figsize=(18, 8))


sns.scatterplot(data=first, x='House_Price_Index', y='Unemployment', ax=axes[0, 0])
axes[0, 0].set_title('2003-2004')


sns.scatterplot(data=first1, x='House_Price_Index', y='Unemployment', ax=axes[0, 1])
axes[0, 1].set_title('2005-2007')

sns.scatterplot(data=second, x='House_Price_Index', y='Unemployment', ax=axes[0, 2])
axes[0, 2].set_title('2008-2011')


sns.scatterplot(data=third, x='House_Price_Index', y='Unemployment', ax=axes[1, 0])
axes[1, 0].set_title('2012-2022')

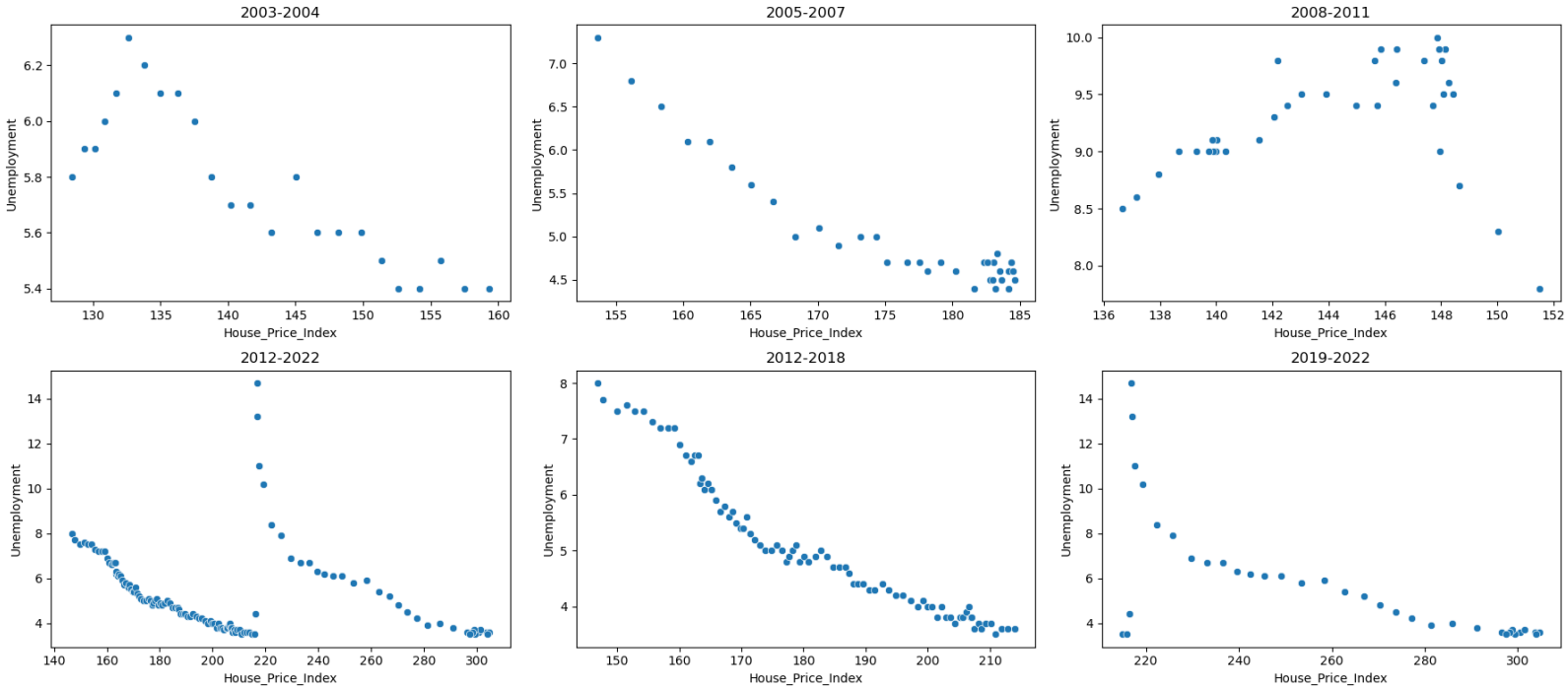
sns.scatterplot(data=fourth, x='House_Price_Index', y='Unemployment', ax=axes[1, 1])
axes[1, 1].set_title('2012-2018')

sns.scatterplot(data=fifth, x='House_Price_Index', y='Unemployment', ax=axes[1, 2])
axes[1, 2].set_title('2019-2022')



plt.tight_layout()

plt.show()
```



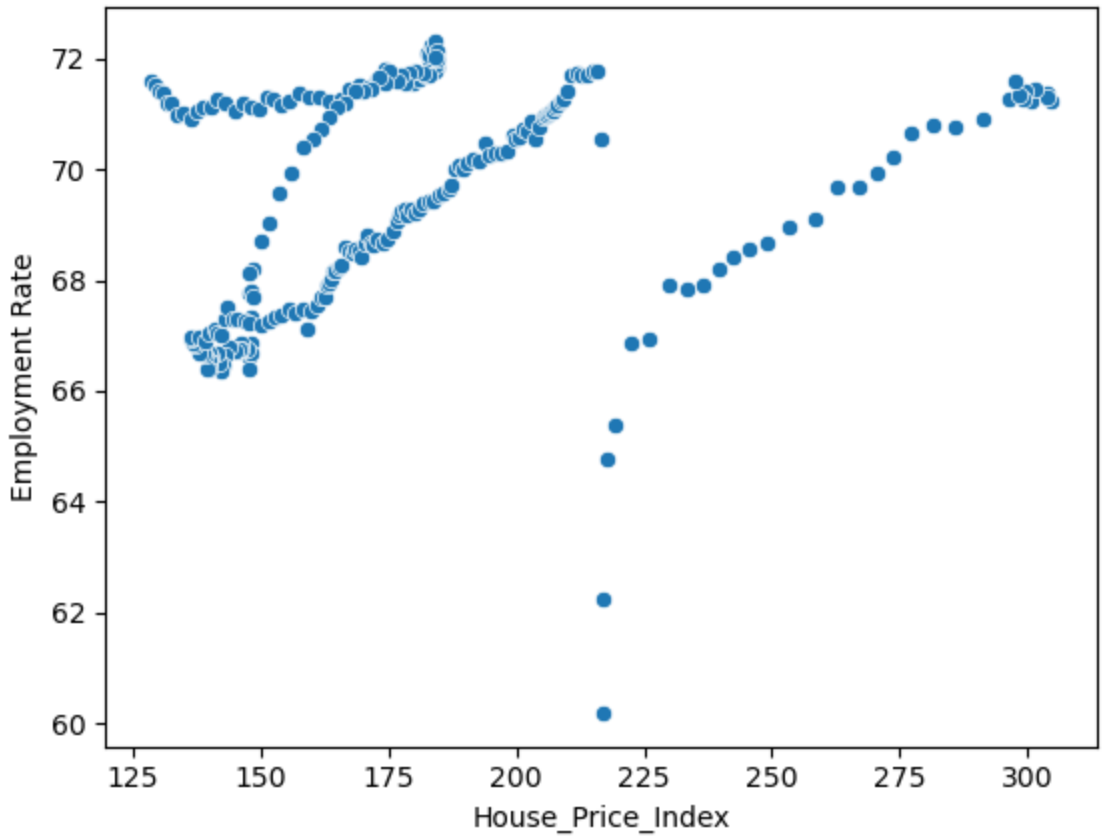

```
# there is Negtive Linear Relationship Between House Price Index and Unmeployment
# During 2003 to 2007, there was drop in unemployment but during period of Great Recession, there was
increase in unemployment
```

In [ ]:

Employment Rate vs House Price Index

In [140]:
```
sns.scatterplot(data=file, y='Employment Rate', x='House_Price_Index')
```

Out[140]:
```
<Axes: xlabel='House_Price_Index', ylabel='Employment Rate'>
```



In [112]:

```
fig, axes = plt.subplots(nrows=2, ncols=3, figsize=(18, 8))


sns.scatterplot(data=first, x='House_Price_Index', y='Employment Rate', ax=axes[0, 0])
axes[0, 0].set_title('2003-2004')


sns.scatterplot(data=first1, x='House_Price_Index', y='Employment Rate', ax=axes[0, 1])
axes[0, 1].set_title('2005-2007')

sns.scatterplot(data=second, x='House_Price_Index', y='Employment Rate', ax=axes[0, 2])
axes[0, 2].set_title('2008-2011')


sns.scatterplot(data=third, x='House_Price_Index', y='Employment Rate', ax=axes[1, 0])
axes[1, 0].set_title('2012-2022')

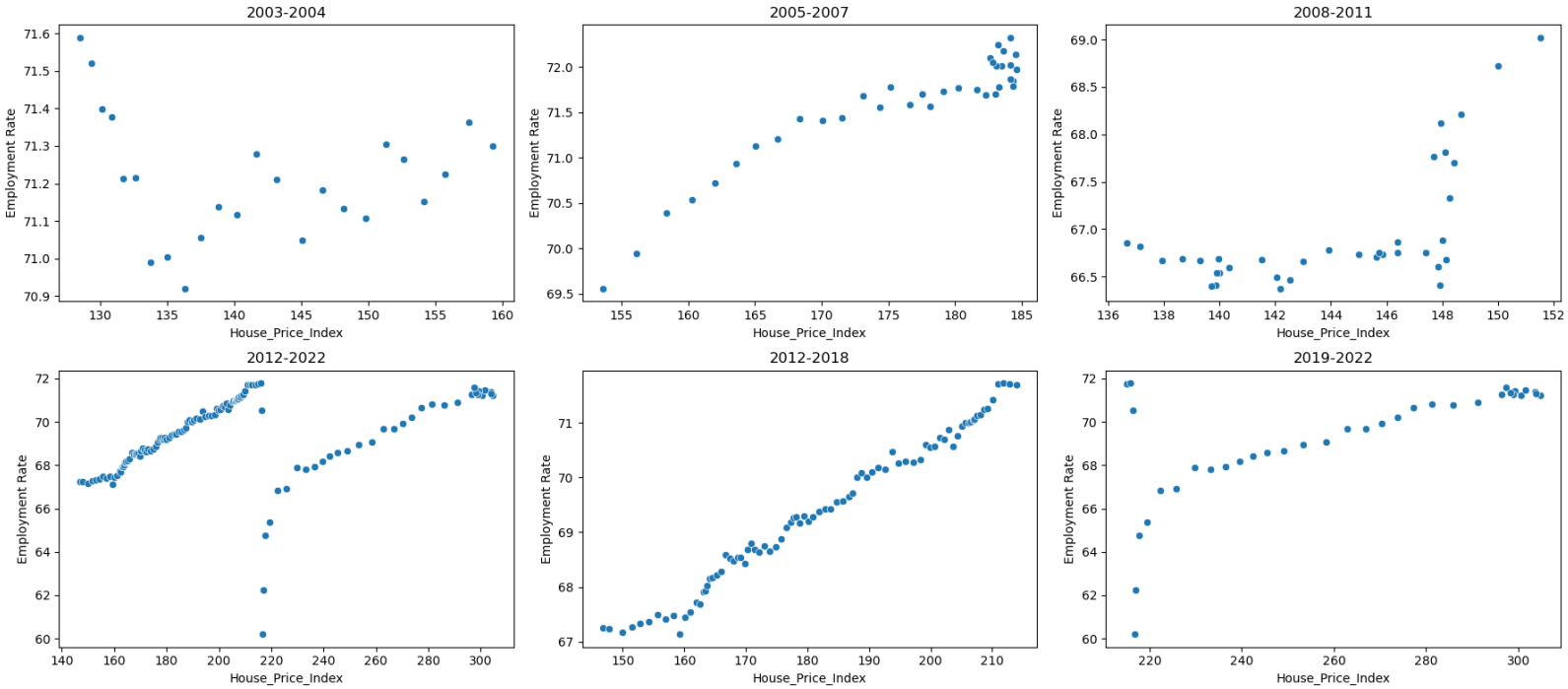
sns.scatterplot(data=fourth, x='House_Price_Index', y='Employment Rate', ax=axes[1, 1])
axes[1, 1].set_title('2012-2018')

sns.scatterplot(data=fifth, x='House_Price_Index', y='Employment Rate', ax=axes[1, 2])
axes[1, 2].set_title('2019-2022')



plt.tight_layout()

plt.show()
```



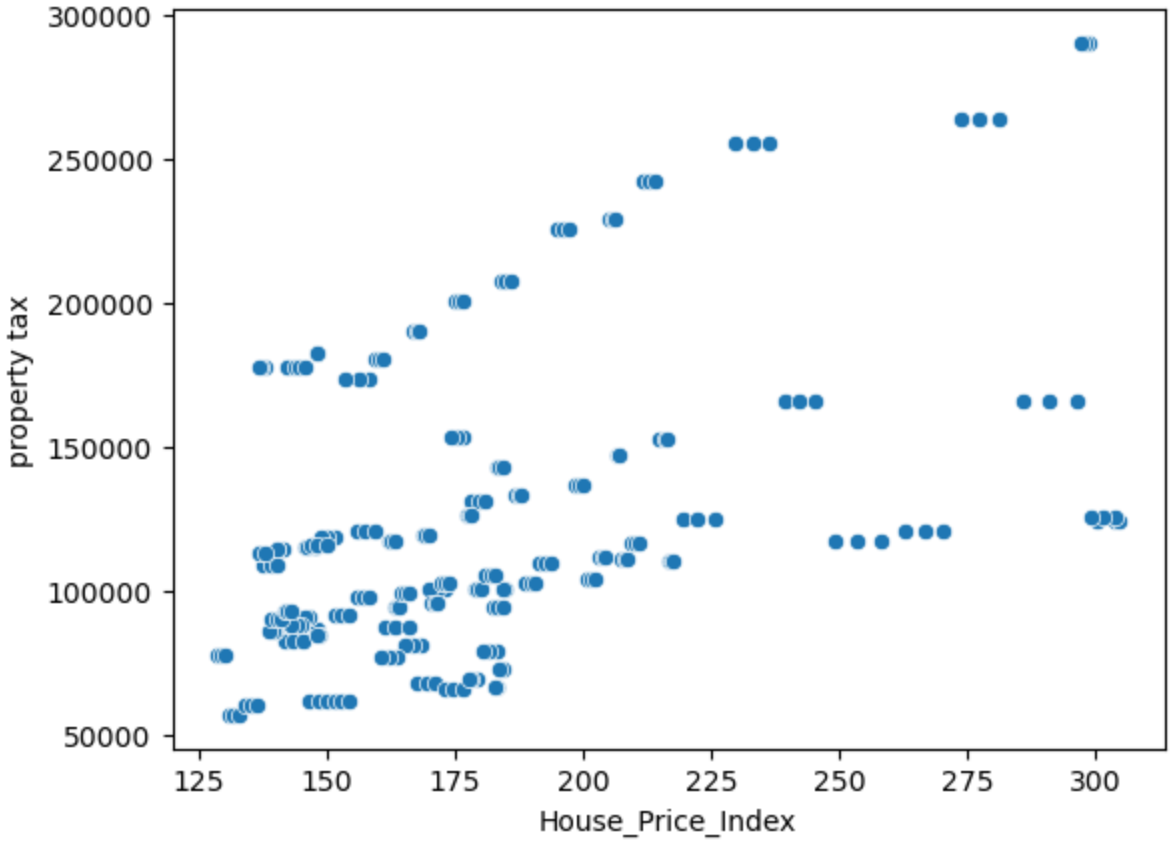

```
# There is Linerar relationship Between Employment Rate and House Price Index
# During 2008-2011, disturbance can be seen when there was Great Recession and effect can be seen on House
Price Index
```

In [ ]:

property tax vs House_Price_Index

In [143]:
```
sns.scatterplot(data=file, y='property tax', x='House_Price_Index')
```

Out[143]: <Axes: xlabel='House_Price_Index', ylabel='property tax'>



In [113]:

```
fig, axes = plt.subplots(nrows=2, ncols=3, figsize=(18, 8))


sns.scatterplot(data=first, x='House_Price_Index', y='property tax', ax=axes[0, 0])
axes[0, 0].set_title('2003-2004')


sns.scatterplot(data=first1, x='House_Price_Index', y='property tax', ax=axes[0, 1])
axes[0, 1].set_title('2005-2007')

sns.scatterplot(data=second, x='House_Price_Index', y='property tax', ax=axes[0, 2])
axes[0, 2].set_title('2008-2011')


sns.scatterplot(data=third, x='House_Price_Index', y='property tax', ax=axes[1, 0])
axes[1, 0].set_title('2012-2022')

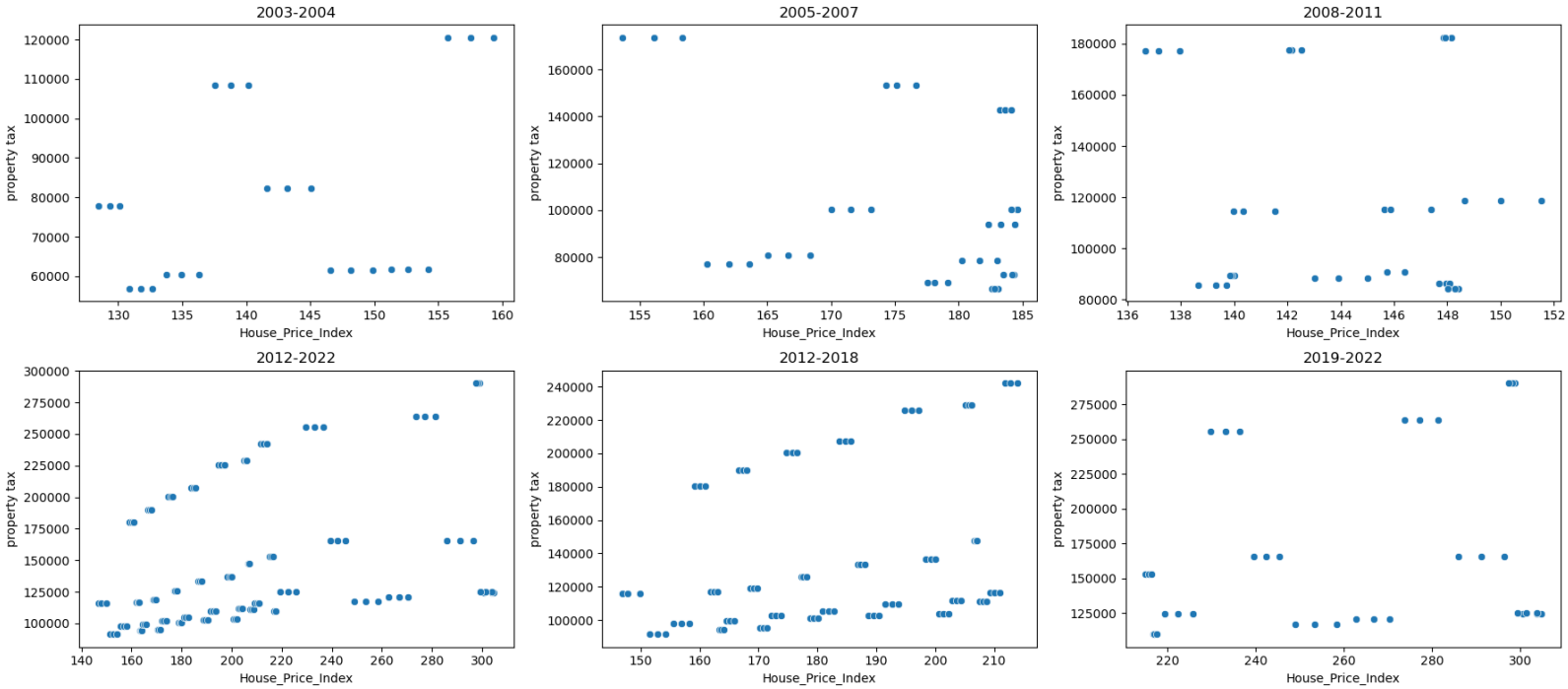
sns.scatterplot(data=fourth, x='House_Price_Index', y='property tax', ax=axes[1, 1])
axes[1, 1].set_title('2012-2018')

sns.scatterplot(data=fifth, x='House_Price_Index', y='property tax', ax=axes[1, 2])
axes[1, 2].set_title('2019-2022')



plt.tight_layout()

plt.show()
```

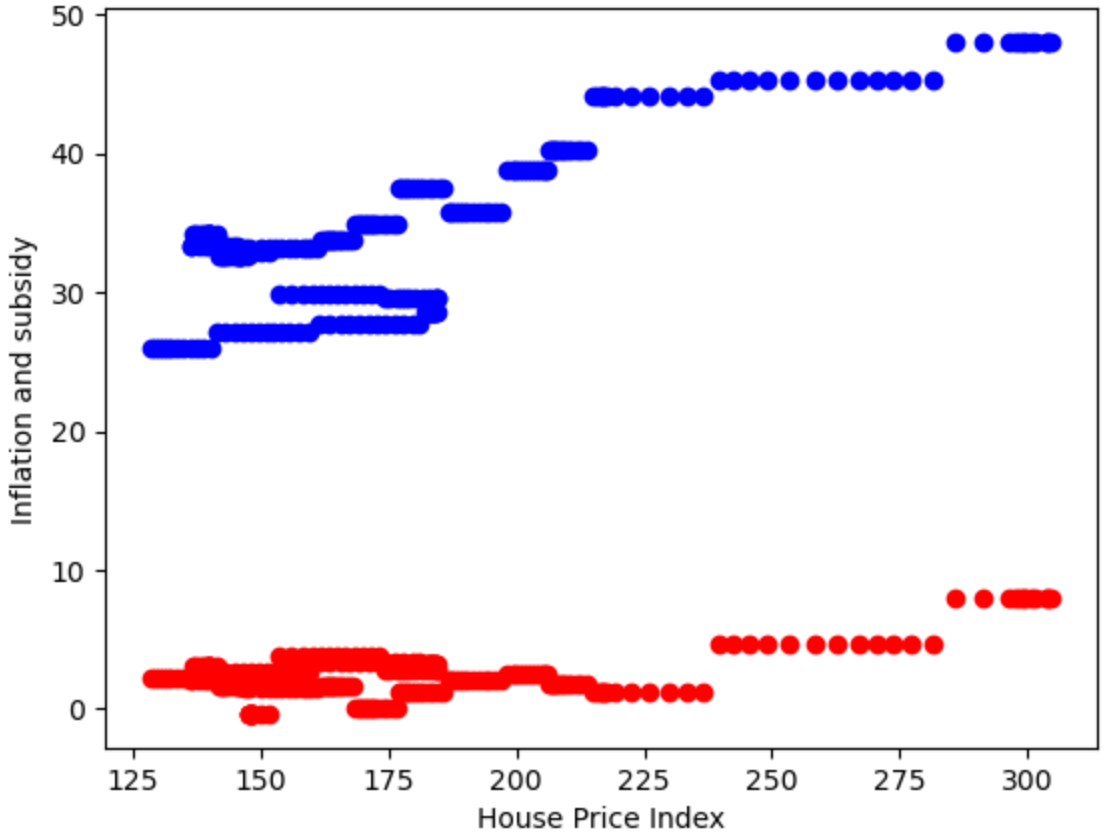



```
# graph shows that there is a positive correlation between property tax and the HPI. This means that when
the HPI increases, property taxes also increase. This is because property taxes are calculated based on
the assessed value of property, which is typically based on the market value of the property.
```

inflation and Subsidy vs House Price Index

In [147]:
```
plt.scatter(file['House_Price_Index'], file['Inflation'], color='red')
plt.scatter(file['House_Price_Index'], file['subsidy'], color='blue')
plt.ylabel('Inflation and subsidy')
plt.xlabel('House Price Index')
```

Out[147]:
```
Text(0.5, 0, 'House Price Index')
```



In [114]:

```
fig, axes = plt.subplots(nrows=2, ncols=3, figsize=(18, 8))


sns.scatterplot(data=first, x='House_Price_Index', y='Inflation', ax=axes[0, 0])
axes[0, 0].set_title('2003-2004')


sns.scatterplot(data=first1, x='House_Price_Index', y='Inflation', ax=axes[0, 1])
axes[0, 1].set_title('2005-2007')

sns.scatterplot(data=second, x='House_Price_Index', y='Inflation', ax=axes[0, 2])
axes[0, 2].set_title('2008-2011')


sns.scatterplot(data=third, x='House_Price_Index', y='Inflation', ax=axes[1, 0])
axes[1, 0].set_title('2012-2022')

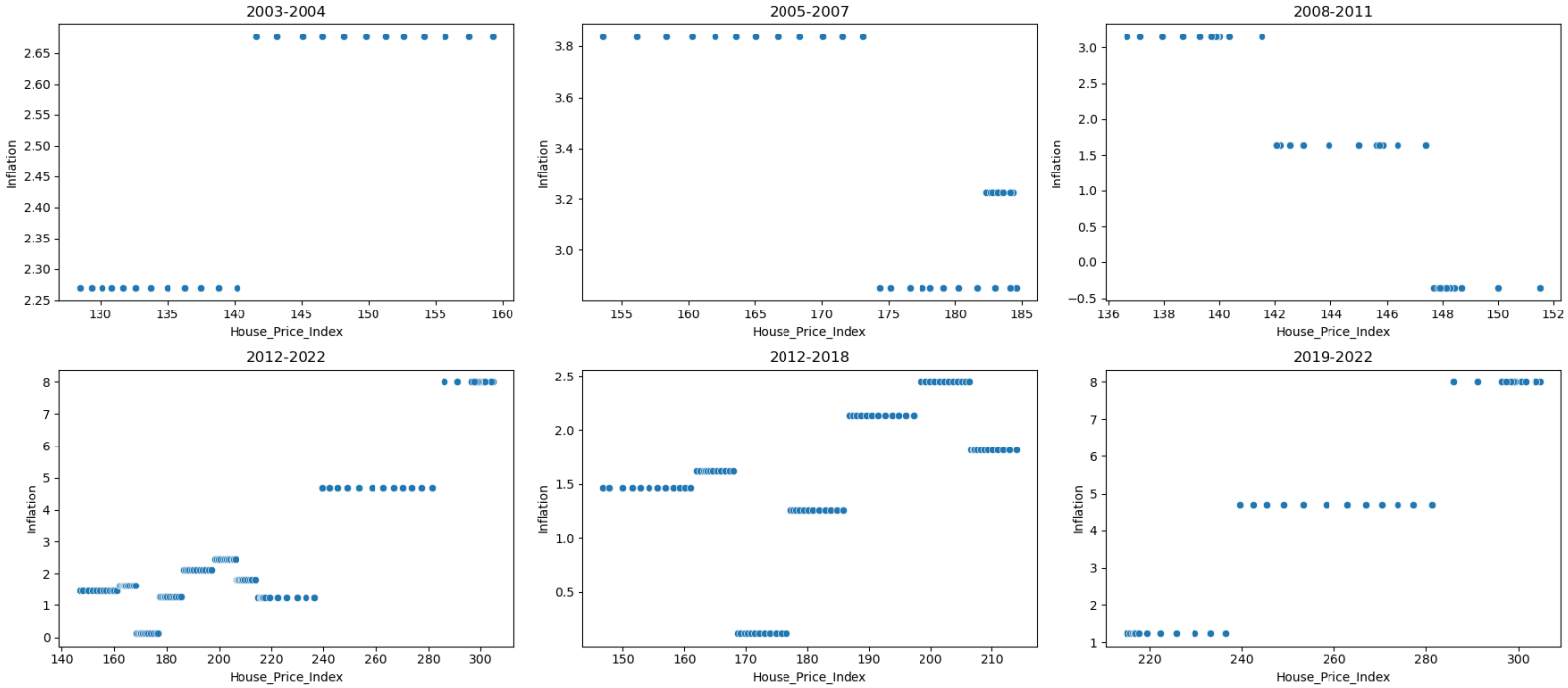
sns.scatterplot(data=fourth, x='House_Price_Index', y='Inflation', ax=axes[1, 1])
axes[1, 1].set_title('2012-2018')

sns.scatterplot(data=fifth, x='House_Price_Index', y='Inflation', ax=axes[1, 2])
axes[1, 2].set_title('2019-2022')



plt.tight_layout()

plt.show()
```


2003-2004
2005-2007
2008-2011
2012-2022
2012-2018
2019-2022
Inflation
House_Price_Index

In [115]:

```
fig, axes = plt.subplots(nrows=2, ncols=3, figsize=(18, 8))


sns.scatterplot(data=first, x='House_Price_Index', y='subsidy', ax=axes[0, 0])
axes[0, 0].set_title('2003-2004')


sns.scatterplot(data=first1, x='House_Price_Index', y='subsidy', ax=axes[0, 1])
axes[0, 1].set_title('2005-2007')

sns.scatterplot(data=second, x='House_Price_Index', y='subsidy', ax=axes[0, 2])
axes[0, 2].set_title('2008-2011')


sns.scatterplot(data=third, x='House_Price_Index', y='subsidy', ax=axes[1, 0])
axes[1, 0].set_title('2012-2022')

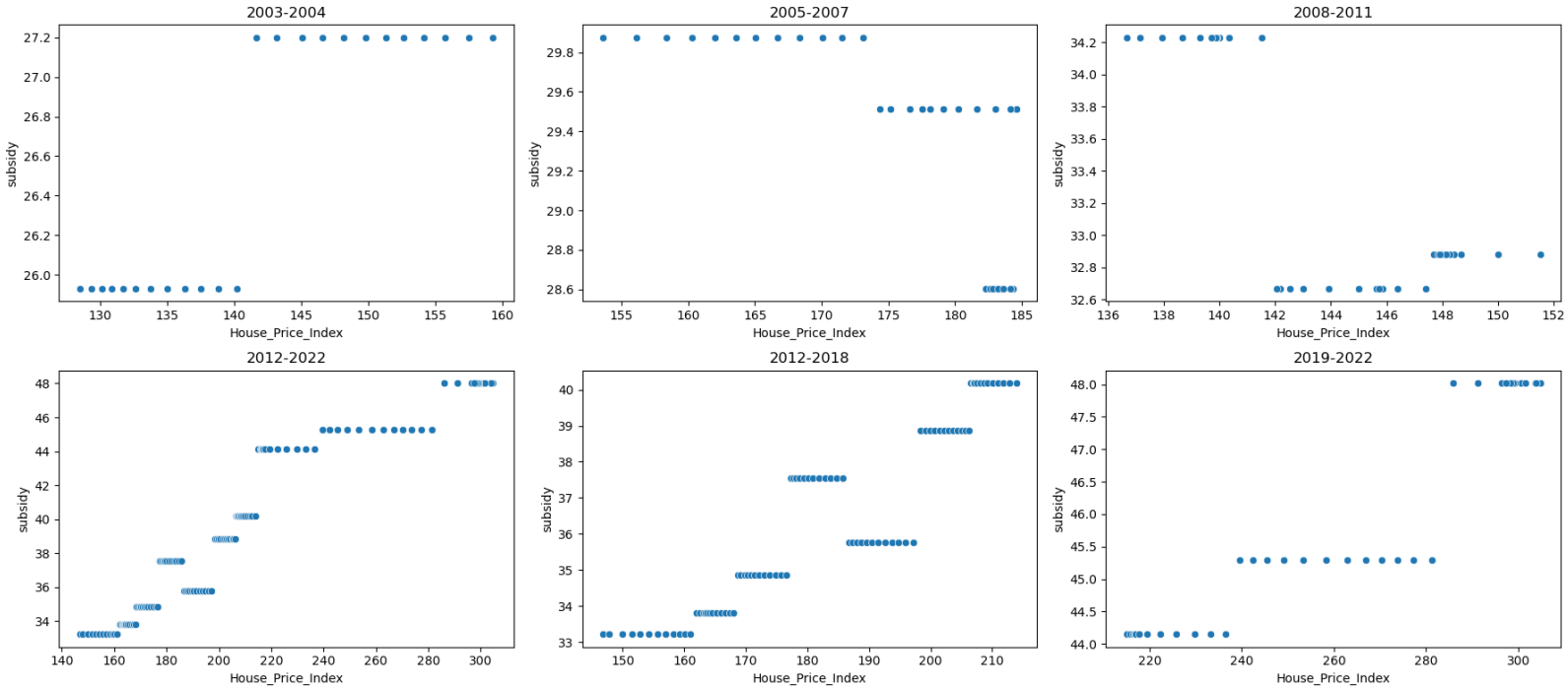
sns.scatterplot(data=fourth, x='House_Price_Index', y='subsidy', ax=axes[1, 1])
axes[1, 1].set_title('2012-2018')

sns.scatterplot(data=fifth, x='House_Price_Index', y='subsidy', ax=axes[1, 2])
axes[1, 2].set_title('2019-2022')



plt.tight_layout()

plt.show()
```




```
# graph shows that there is a positive correlation between subsidies and the house price index. This means
that when subsidies increase, the house price index also increases. This is because subsidies make housing
more affordable, which increases demand. This leads to an increase in the house price index,

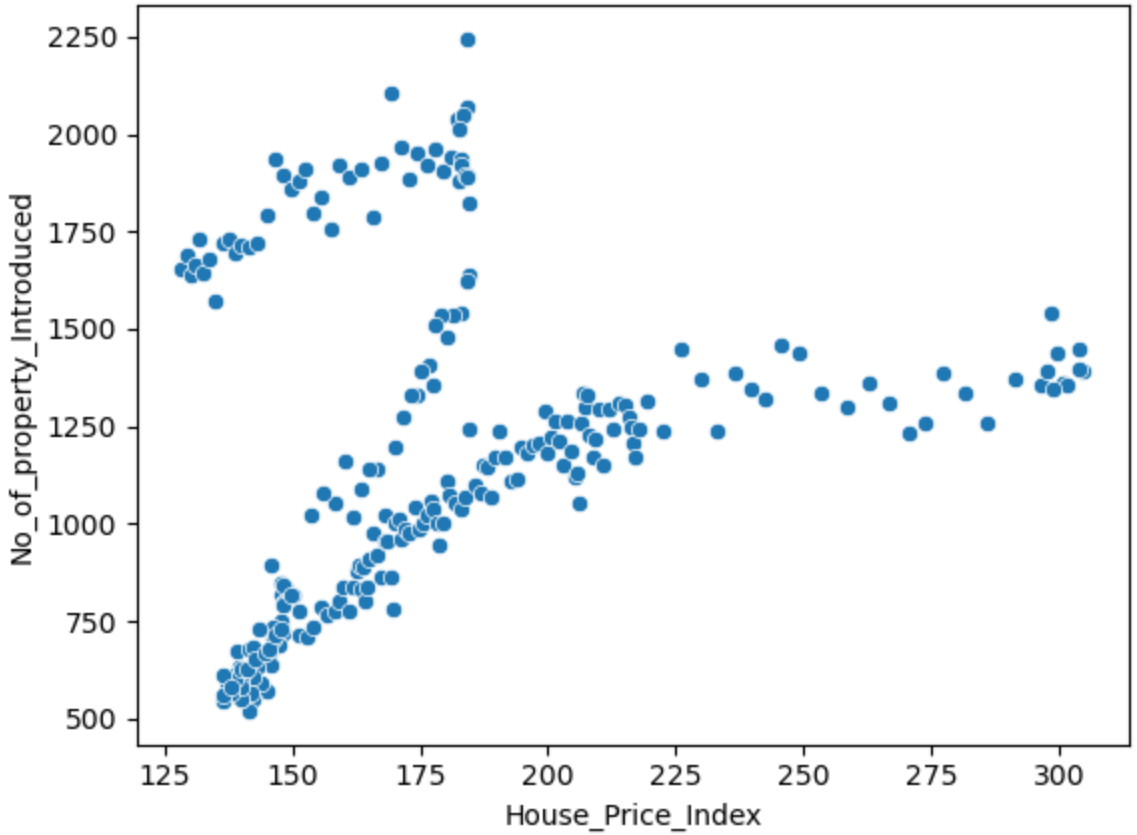
# Inflation is the rate at which prices for goods and services are increasing. The house price index is
the average price of all properties sold in a given period.graph shows that there is a general positive
correlation between inflation and the house price index. This means that when inflation increases, the
house price index also increases. This is because inflation makes all assets, including homes, more
expensive. However, there are also periods of time when the house price index has risen faster than
inflation
```

In [ ]:

No_of_property_Introduced vs House_Price_Index

In [148]:
```
sns.scatterplot(data=file, x='House_Price_Index', y='No_of_property_Introduced')
```

Out[148]: <Axes: xlabel='House_Price_Index', ylabel='No_of_property_Introduced'>



In [117]:

```
fig, axes = plt.subplots(nrows=2, ncols=3, figsize=(18, 8))


sns.scatterplot(data=first, x='House_Price_Index', y='No_of_property_Introduced', ax=axes[0, 0])
axes[0, 0].set_title('2003-2004')


sns.scatterplot(data=first1, x='House_Price_Index', y='No_of_property_Introduced', ax=axes[0, 1])
axes[0, 1].set_title('2005-2007')

sns.scatterplot(data=second, x='House_Price_Index', y='No_of_property_Introduced', ax=axes[0, 2])
axes[0, 2].set_title('2008-2011')


sns.scatterplot(data=third, x='House_Price_Index', y='No_of_property_Introduced', ax=axes[1, 0])
axes[1, 0].set_title('2012-2022')

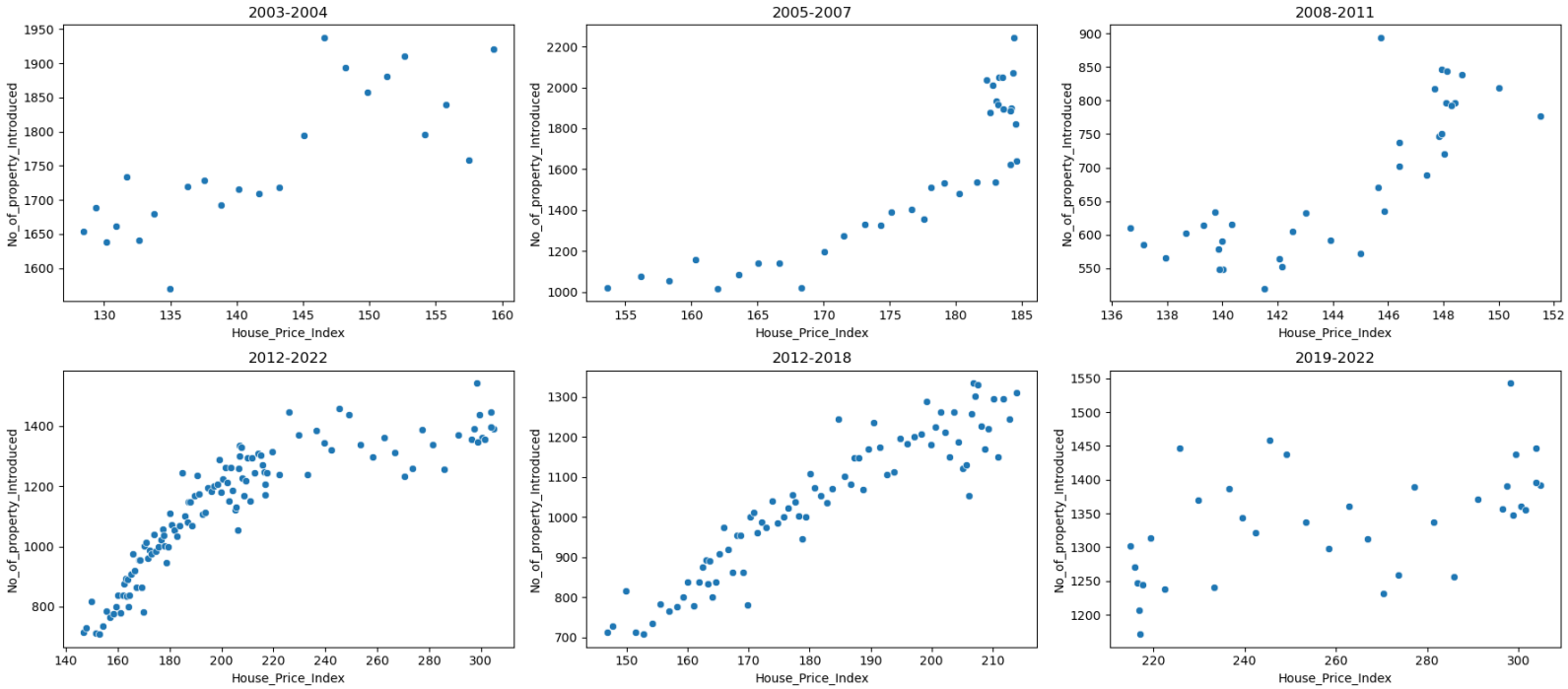
sns.scatterplot(data=fourth, x='House_Price_Index', y='No_of_property_Introduced', ax=axes[1, 1])
axes[1, 1].set_title('2012-2018')

sns.scatterplot(data=fifth, x='House_Price_Index', y='No_of_property_Introduced', ax=axes[1, 2])
axes[1, 2].set_title('2019-2022')



plt.tight_layout()

plt.show()
```



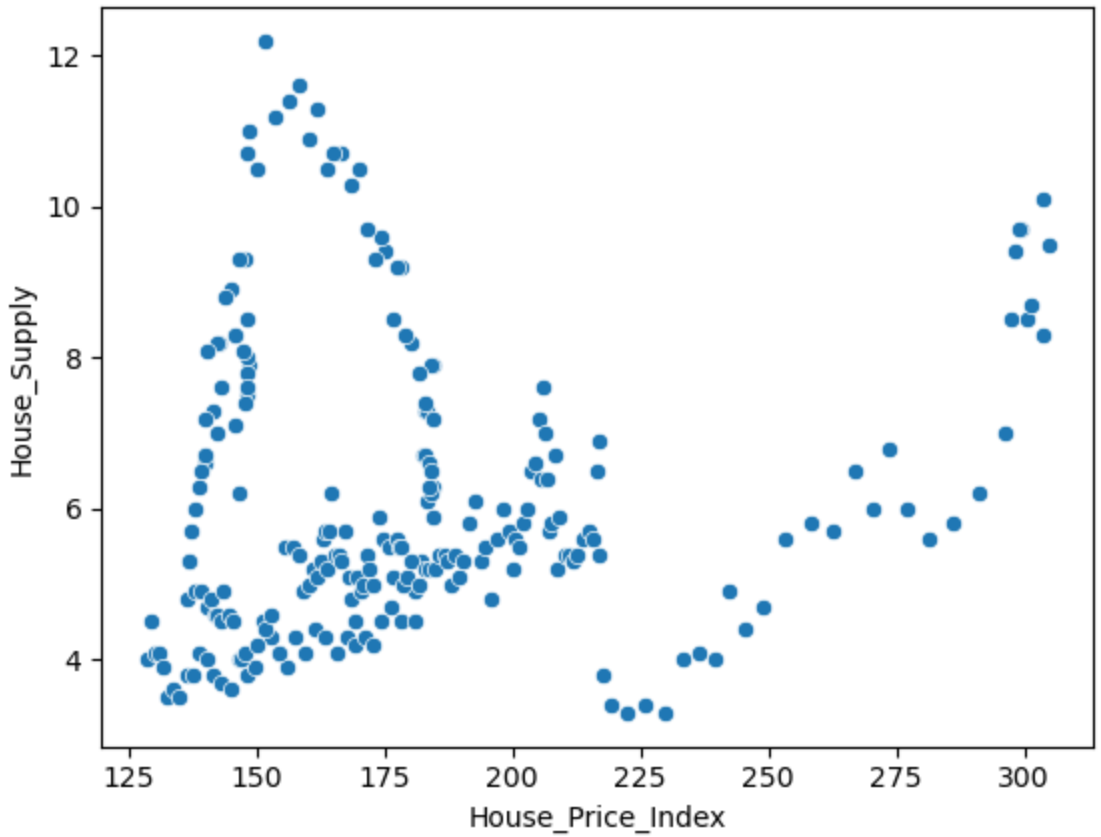

```
# The scatter plot in the image shows the relationship between the number of properties introduced and the
house price index in the United States from 1900 to 2022. The number of properties introduced is the
number of properties that have been introduced to the market. The house price index is the average price
of all properties sold in a given period

# graph shows that there is a positive correlation between the number of properties introduced and the
house price index. This means that when the number of properties introduced increases, the house price
index also increases
```

House_Supply vs House_Price_Index

In [151]:
```
sns.scatterplot(data=file, x='House_Price_Index', y='House_Supply')
```

Out[151]:
```
<Axes: xlabel='House_Price_Index', ylabel='House_Supply'>
```



In [116]:

```
fig, axes = plt.subplots(nrows=2, ncols=3, figsize=(18, 8))


sns.scatterplot(data=first, x='House_Price_Index', y='House_Supply', ax=axes[0, 0])
axes[0, 0].set_title('2003-2004')


sns.scatterplot(data=first1, x='House_Price_Index', y='House_Supply', ax=axes[0, 1])
axes[0, 1].set_title('2005-2007')

sns.scatterplot(data=second, x='House_Price_Index', y='House_Supply', ax=axes[0, 2])
axes[0, 2].set_title('2008-2011')


sns.scatterplot(data=third, x='House_Price_Index', y='House_Supply', ax=axes[1, 0])
axes[1, 0].set_title('2012-2022')

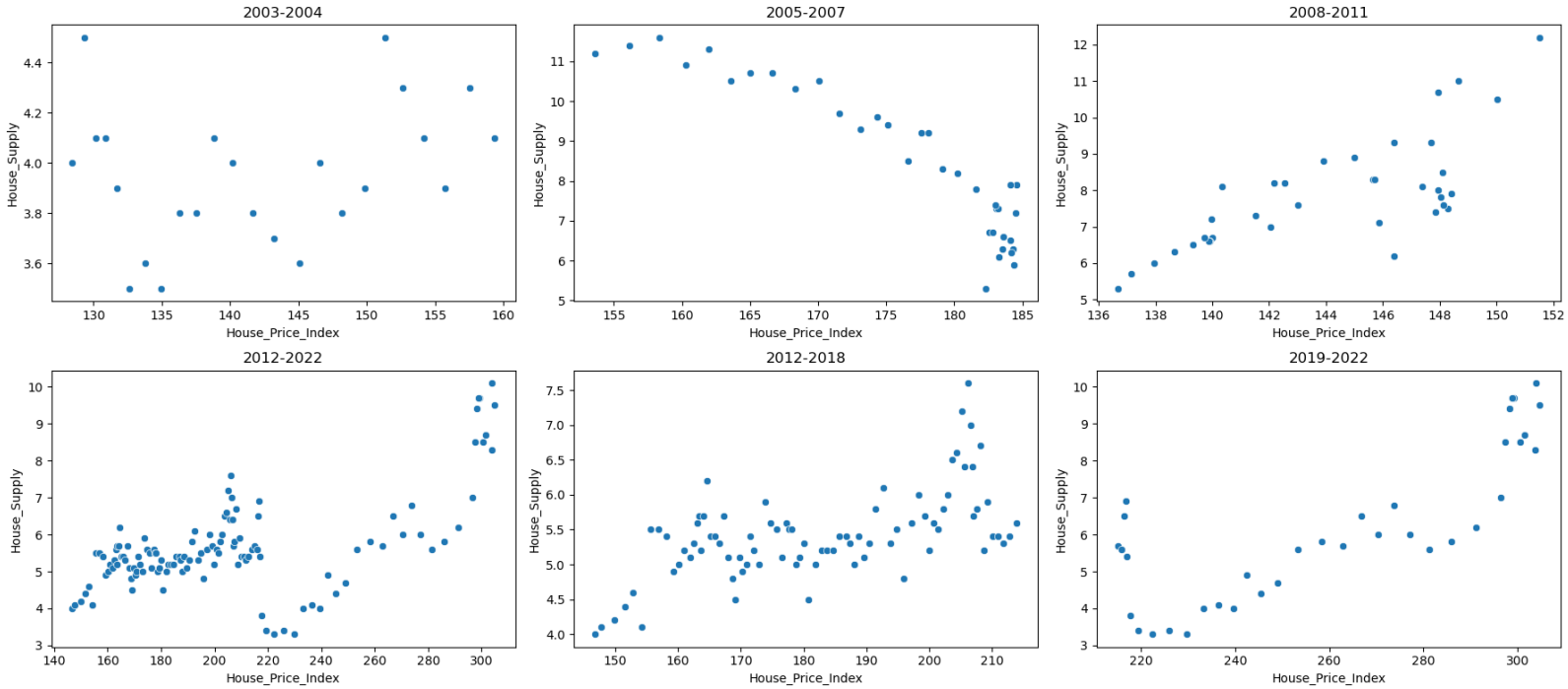
sns.scatterplot(data=fourth, x='House_Price_Index', y='House_Supply', ax=axes[1, 1])
axes[1, 1].set_title('2012-2018')

sns.scatterplot(data=fifth, x='House_Price_Index', y='House_Supply', ax=axes[1, 2])
axes[1, 2].set_title('2019-2022')



plt.tight_layout()

plt.show()
```




```
# The house price index and house supply have a negative relationship. This means that when the house
price index increases, the house supply decreases. This is because as the price of houses increases, fewer
people are able to afford to buy them, which reduces demand. This leads to a decrease in the house supply,
as sellers are less likely to sell their homes if they know that there is less demand for them.

The scatter plot in the image shows the relationship between the house price index and house supply in the
United States from 2003 to 2022. As you can see, there is a clear negative correlation between the two
variables. In periods when the house price index was high, such as in 2005-2007, the house supply was low.
Conversely, in periods when the house price index was low, such as in 2008-2011, the house supply was
high.

Economic conditions: A strong economy will typically lead to higher demand for housing, which can drive up
house prices and reduce house supply.
Interest rates: Higher interest rates can make it more expensive to borrow money to buy a home, which can
reduce demand and increase house supply.
Government policies: Government policies, such as tax breaks for first-time homebuyers, can increase
demand for housing and drive up house prices.
```

In [ ]:

```
```

Report

```
# House_Price_Index

# there was rise in house price from 2004 to 2006
# dcline in house Price from 2007 upto 2012
# there was rise in house price index from 2013
# there was revolutionary change from 2020  and onword
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# PPI vs House_Price_Index

#  The Producer Price Index by Commodity: Special Indexes: Construction Materials (PPI-CM) is a
statistical measure of the change in prices paid by producers for materials and components used in
construction
# there is sort of linear relationship between PPi and Price of Houses,if PPI increase then house prices
will increase as well
# in between 2008 to 2013,when PPI is high but house price index is low this is because of Great
Recession, this means for construction high expenses was incurred as compared to price charged from
customers
# from 2003 to 2005, when there is rise in Producer Price Index and House Price Index, there is Linear
relationship between PPI and House Price Index. it s contributing as well in consistent rise in House
Price Index
# During 2008 and 2011, There is negtive relationship between House Price Index and Producer Price Index
due to Great Recession
# as per above graph, economy is trying to recover from Recession
# Again PPI and House Price Index started lising Linearly from 2012


# population and working Population vs House_Price_Index

# as per above both graphs, as you can see when population is rising the house price index is rising as
well, but during 2008 to 2013 due to great recession house price index droped and then again started
rising


# Real_m2 vs House_Price_Index
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# Real M2 and House Price Index, there is linear relationship between real M2 and House Price index, affect of Great Recession can be seen in graph, otherwise there is clear linear relationship between Real M2 and House Price Index
# When Real Money Stock is rising and House Price Index is rising as well

# in Between 2003 and 2005, there is aggresive increase in Real M2 but House Price is increasing at normal rate in start

# During 2008- 2011, there is negtive Linear Relationship between Real M2 and House Price Index, Supply of money after considering inflation is decreasing

# During 2019 and 2022, there was drastic chnage in Real M2 and then increase in real m2 was normal


# Velocity_m2 vs House_Price_Index

# there is negtive Linear relationship between House Price Index and Velocity M2 and affect of Great Recession can be seen in graph

#Government_Exp vs House_Price_Index

## During 2003 and 2005, there is linear relationship between House Price Index and Governement exp, economy growth is normal
# During 2008 and 2011 and 2005 and 2007 , when there was situation of Great Recession, there was drop of Government expensiture

# During 2012 - 2018, government incurred expenditure to revive the economy  from Recession as per requirement
# during 2019 to 2022, which was period of covid, government incurred even high as compared to previous records

# Urban_cpi vs House_Price_Index

# There is Linear relationship between Urban_cpi and House Price Index, also the affect of Great Recession can be seen in graph

# During 2005-2007 and 2008-2011, When there was Great Recession, drop of Urban Consumer Price Index and House Price Index can be seen

# During 2012-2018, consistent rise in urban consumer price index and House Price Index can be seen when economy started Recovering from Great Recession
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# During 2021 and 2022, there was drastic change in Consumer Price Index, this could be due to end of
lockdown due to covid



# Income vs House Price Index

# there is sort of Linear Relationship Between Income and House Price Index, it contains some Outliers
# also the affect of Great Recession can be seen
# if income will increase then demand of houses will increase too which will lead to high price index, if
supply of house is not enough to meet demand
# income does not contribute much in increasing the House Price Index
# There are Two siuation first is of Great Recession and and Covid
# During 2005-2007 and 2008-2011, there was situation of Great Recession, reduction can be seen in income
level and House Price Index
# During the 2019-2022, small drop can be seen in House Price Index and Income Level


# GDP vs House Price Index

# if we do not consider the situation of covid and Great Recession, there was linear relationship between
GDP and House Price Index
# During 2008 and 2011, there was drop in GDP and House Price Index due to Great Recession
# During 2019-2022, there was drop in gdp during COVID but after slowly is started to reach on top

# CPI vs House Price Index

# it is same as urban cpi, during Great Recession there was decrese in CPI
# there was little drop in CPI during COVID


# Interest_Rate vs House Price Index

# it is effective interest rate which is charged by central bank from other bank banks for lending

# when there was situation of Great Recession and COVID, Effective Interest rate increased,
# During 2019-2021, there was drop of economic activities, requirement of funds droped as well, this led
to the lower efective interest rate


# Unemployment vs House Price Index

# there is Negtive Linear Relationship Between House Price Index and Unmeployment
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# During 2003 to 2007, there was drop in unemployment but during period of Great Recession, there was
increase in unemployment



# Employment Rate vs House Price Index
# There is Linerar relationship Between Employment Rate and House Price Index
# During 2008-2011, disturbance can be seen when there was Great Recession and effect can be seen on House
Price Index



# House_Supply vs House_Price_Index
# The house price index and house supply have a negative relationship. This means that when the house
price index increases, the house supply decreases. This is because as the price of houses increases, fewer
people are able to afford to buy them, which reduces demand. This leads to a decrease in the house supply,
as sellers are less likely to sell their homes if they know that there is less demand for them.

The scatter plot in the image shows the relationship between the house price index and house supply in the
United States from 2003 to 2022. As you can see, there is a clear negative correlation between the two
variables. In periods when the house price index was high, such as in 2005-2007, the house supply was low.
Conversely, in periods when the house price index was low, such as in 2008-2011, the house supply was
high.


# No_of_property_Introduced vs House_Price_Index

# The scatter plot in the image shows the relationship between the number of properties introduced and the
house price index in the United States from 1900 to 2022. The number of properties introduced is the
number of properties that have been introduced to the market. The house price index is the average price
of all properties sold in a given period

# graph shows that there is a positive correlation between the number of properties introduced and the
house price index. This means that when the number of properties introduced increases, the house price
index also increases


# inflation and Subsidy vs House Price Index

# graph shows that there is a positive correlation between subsidies and the house price index. This means
that when subsidies increase, the house price index also increases. This is because subsidies make housing
more affordable, which increases demand. This leads to an increase in the house price index,
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# Inflation is the rate at which prices for goods and services are increasing. The house price index is
the average price of all properties sold in a given period.graph shows that there is a general positive
correlation between inflation and the house price index. This means that when inflation increases, the
house price index also increases. This is because inflation makes all assets, including homes, more
expensive. However, there are also periods of time when the house price index has risen faster than
inflation


# property tax vs House_Price_Index
# graph shows that there is a positive correlation between property tax and the HPI. This means that when
the HPI increases, property taxes also increase. This is because property taxes are calculated based on
the assessed value of property, which is typically based on the market value of the property.
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Overall Report

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House Price Index Report Summary
Overall Trend:

The house price index has been rising steadily since 2003, with a few exceptions. There were significant
declines during the Great Recession (2008-2011) and a minor dip during the COVID-19 pandemic (2019-2022).

Key Factors Influencing House Price Index:

Producer Price Index (PPI): There is a general positive correlation between PPI and the house price index.
When the cost of construction materials increases, house prices are likely to follow suit.
Population and Working Population: As the population grows, the demand for housing increases, leading to
higher prices.
Real M2: This refers to the amount of money circulating in the economy after adjusting for inflation.
There is a positive correlation between Real M2 and the house price index.
Velocity M2: This measures how quickly money circulates in the economy. There is a negative correlation
between Velocity M2 and the house price index.
Government Expenditure: Government spending can stimulate the economy and lead to higher house prices.
Urban CPI: The Urban Consumer Price Index measures inflation for urban households. There is a positive
correlation between Urban CPI and the house price index.
Income: There is a positive correlation between income and the house price index. Higher incomes allow
people to afford more expensive houses.
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GDP: There is a positive correlation between GDP and the house price index. A strong economy leads to higher demand for housing, which can drive up prices.
Interest Rate: The effective interest rate charged by banks can influence the demand for housing. Lower interest rates make it easier for people to afford mortgages, which can lead to higher house prices.
Unemployment: There is a negative correlation between unemployment and the house price index. Higher unemployment rates lead to lower demand for housing, which can depress prices.
Employment Rate: There is a positive correlation between the employment rate and the house price index. A higher number of people employed means more potential buyers, which can lead to higher house prices.
House Supply: There is a negative correlation between house supply and the house price index. A higher supply of houses can lead to lower prices, while a lower supply can lead to higher prices.
No. of Property Introduced: There is a positive correlation between the number of properties introduced and the house price index. This is likely because a higher supply of properties can lead to lower prices.
Inflation and Subsidy: There is a positive correlation between subsidies and the house price index. Subsidies make housing more affordable, which increases demand and can lead to higher prices. There is also a general positive correlation between inflation and the house price index, as inflation makes all assets, including homes, more expensive.
Property Tax: There is a positive correlation between property tax and the house price index. This is because property taxes are calculated based on the assessed value of property, which is typically based on the market value of the property.
Future Outlook:

The future outlook for the house price index is uncertain. Some factors, such as rising interest rates and a potential recession, could lead to lower prices. However, other factors, such as a strong economy and a growing population, could support continued price growth.

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