In [28]:

```
# importing libraries
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
import warnings
warnings.filterwarnings('ignore')
```

In [2]:

```
#Prepared dataframe by reading the Case-Shiller index which was downloaded from the proxy link.
#Reading CASE-SHILLER Index into a dataframe
df_price = pd.read_csv("CASESHILLER.csv")
df_price
```

Out[2]:

```
           DATE  CSUSHPISA
  0  1987-01-01     63.965
  1  1987-02-01     64.424
  2  1987-03-01     64.736
  3  1987-04-01     65.132
  4  1987-05-01     65.563
...         ...        ...
436  2023-05-01    302.566
437  2023-06-01    304.593
438  2023-07-01    306.767
439  2023-08-01    309.155
440  2023-09-01    311.175

441 rows × 2 columns
```

In [3]:

```python
#Changing dtype of date column
df_price["DATE"] = pd.to_datetime(df_price["DATE"])
print(df_price.shape)
#Selecting data between 2001  to 2023
date_range = df_price["DATE"] >= "2001-07-01"
df_price = df_price[date_range]
#Resetting Index
df_price.reset_index(inplace = True)
df_price.drop(columns = ["index"], inplace = True)
# Creating "Year" and "Month" columns
df_price["Year"] = pd.DatetimeIndex(df_price["DATE"]).year
df_price["Month"] = pd.DatetimeIndex(df_price["DATE"]).month
df_price
```

```
(441, 2)

/var/folders/5_/zt1gkvk17s534j4yb6f487_40000gn/T/ipykernel_61279/1684670537.py:9: 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/indexing.html#returni
ng-a-view-versus-a-copy (https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-ver
sus-a-copy)
  df_price.drop(columns = ["index"], inplace = True)
/var/folders/5_/zt1gkvk17s534j4yb6f487_40000gn/T/ipykernel_61279/1684670537.py:11: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returni
ng-a-view-versus-a-copy (https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-ver
sus-a-copy)
  df_price["Year"] = pd.DatetimeIndex(df_price["DATE"]).year
/var/folders/5_/zt1gkvk17s534j4yb6f487_40000gn/T/ipykernel_61279/1684670537.py:12: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returni
ng-a-view-versus-a-copy (https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-ver
sus-a-copy)
  df_price["Month"] = pd.DatetimeIndex(df_price["DATE"]).month
```

Out[3]:

```
           DATE  CSUSHPISA  Year  Month
0    2001-07-01    113.491  2001      7
1    2001-08-01    114.167  2001      8
2    2001-09-01    114.812  2001      9
3    2001-10-01    115.310  2001     10
4    2001-11-01    115.857  2001     11
...         ...        ...   ...    ...
262  2023-05-01    302.566  2023      5
263  2023-06-01    304.593  2023      6
264  2023-07-01    306.767  2023      7
265  2023-08-01    309.155  2023      8
266  2023-09-01    311.175  2023      9

267 rows × 4 columns
```

In [4]:

```python
# Interest Rate Data
df_Fed_rate = pd.read_csv("interesrate.csv").drop([267,268])
df_Fed_rate["DATE"] = pd.to_datetime(df_Fed_rate["DATE"])
print(df_Fed_rate.shape)
df_Fed_rate
```

```
(267, 2)
```

Out[4]:

	DATE	FEDFUNDS
0	2001-07-01	3.77
1	2001-08-01	3.65
2	2001-09-01	3.07
3	2001-10-01	2.49
4	2001-11-01	2.09
...	...	...
262	2023-05-01	5.06
263	2023-06-01	5.08
264	2023-07-01	5.12
265	2023-08-01	5.33
266	2023-09-01	5.33

267 rows × 2 columns

```
In [5]: # Unemployement Rate
        df_unemp = pd.read_csv("UNRATE.csv")
        df_unemp["DATE"] = pd.to_datetime(df_unemp["DATE"])
        df_unemp.drop([267,268], inplace = True)
        df_unemp
```

```
Out[5]:
              DATE  UNRATE
        0   2001-07-01     4.6
        1   2001-08-01     4.9
        2   2001-09-01     5.0
        3   2001-10-01     5.3
        4   2001-11-01     5.5
      ...          ...     ...
      262   2023-05-01     3.7
      263   2023-06-01     3.6
      264   2023-07-01     3.5
      265   2023-08-01     3.8
      266   2023-09-01     3.8

      267 rows × 2 columns
```

In [6]:

```
# Construction not stated
not_constr_startd= pd.read_csv('Not_Started_Construct .csv')  # thousands of units
not_constr_startd["DATE"] = pd.to_datetime(not_constr_startd["DATE"])

not_constr_startd.drop([267], inplace = True)
not_constr_startd.tail()
```

Out[6]:

	DATE	NHFSEPNTS
262	2023-05-01	92.0
263	2023-06-01	93.0
264	2023-07-01	96.0
265	2023-08-01	97.0
266	2023-09-01	101.0

In [7]:

```
# House under cinstrucion :-- Underconstruction
# link :- https://fred.stlouisfed.org/series/NHFSEPUCS/
df_underconst= pd.read_csv("Under_construction.csv")
#Changing dtype of date column
df_underconst["DATE"] = pd.to_datetime(df_underconst["DATE"])
df_underconst.drop([267], inplace = True)
print(df_underconst.shape)
df_underconst.tail()
```

```
(267, 2)
```

Out[7]:

	DATE	NHFSEPUCS
262	2023-05-01	268.0
263	2023-06-01	266.0
264	2023-07-01	260.0
265	2023-08-01	258.0
266	2023-09-01	257.0

In [8]:

```
# Comstruction completed
df_const_completed= pd.read_csv("Cons_Completed.csv")
#Changing dtype of date column
df_const_completed["DATE"] = pd.to_datetime(df_const_completed["DATE"])
df_const_completed.drop([267], inplace = True)
print(df_const_completed.shape)
df_const_completed.tail()
```

```
(267, 2)
```

Out[8]:

	DATE	NHFSEPCS
262	2023-05-01	66.0
263	2023-06-01	70.0
264	2023-07-01	73.0
265	2023-08-01	75.0
266	2023-09-01	75.0

```
In [9]: df_under_compl= pd.merge(df_const_completed,df_underconst,on='DATE',how='inner')    #joining
        df_under_compl
```

```
Out[9]:
                DATE  NHFSEPCS  NHFSEPUCS
       0  2001-07-01      76.0      186.0
       1  2001-08-01      77.0      187.0
       2  2001-09-01      79.0      191.0
       3  2001-10-01      78.0      189.0
       4  2001-11-01      77.0      191.0
     ...         ...       ...        ...
     262  2023-05-01      66.0      268.0
     263  2023-06-01      70.0      266.0
     264  2023-07-01      73.0      260.0
     265  2023-08-01      75.0      258.0
     266  2023-09-01      75.0      257.0

    267 rows × 3 columns
```

```
In [10]: df_not_unemp =pd.merge(not_constr_startd,df_unemp,on='DATE',how='inner')
         df_not_unemp
```

```
Out[10]:
               DATE  NHFSEPNTS  UNRATE
        0  2001-07-01       43.0     4.6
        1  2001-08-01       44.0     4.9
        2  2001-09-01       40.0     5.0
        3  2001-10-01       41.0     5.3
        4  2001-11-01       40.0     5.5
      ...         ...        ...     ...
      262  2023-05-01       92.0     3.7
      263  2023-06-01       93.0     3.6
      264  2023-07-01       96.0     3.5
      265  2023-08-01       97.0     3.8
      266  2023-09-01      101.0     3.8

     267 rows × 3 columns
```

```
In [11]: join_df = pd.merge(df_under_compl,df_not_unemp,on='DATE',how='inner')
         join_df
```

```
Out[11]:
                DATE  NHFSEPCS  NHFSEPUCS  NHFSEPNTS  UNRATE
       0  2001-07-01      76.0      186.0       43.0     4.6
       1  2001-08-01      77.0      187.0       44.0     4.9
       2  2001-09-01      79.0      191.0       40.0     5.0
       3  2001-10-01      78.0      189.0       41.0     5.3
       4  2001-11-01      77.0      191.0       40.0     5.5
     ...         ...       ...        ...        ...     ...
     262  2023-05-01      66.0      268.0       92.0     3.7
     263  2023-06-01      70.0      266.0       93.0     3.6
     264  2023-07-01      73.0      260.0       96.0     3.5
     265  2023-08-01      75.0      258.0       97.0     3.8
     266  2023-09-01      75.0      257.0      101.0     3.8

    267 rows × 5 columns
```

```
In [12]: join_data_df = pd.merge(join_df,df_price,on='DATE',how='inner')
         join_data_df
```

Out[12]:

	DATE	NHFSEPCS	NHFSEPUCS	NHFSEPNTS	UNRATE	CSUSHPISA	Year	Month
0	2001-07-01	76.0	186.0	43.0	4.6	113.491	2001	7
1	2001-08-01	77.0	187.0	44.0	4.9	114.167	2001	8
2	2001-09-01	79.0	191.0	40.0	5.0	114.812	2001	9
3	2001-10-01	78.0	189.0	41.0	5.3	115.310	2001	10
4	2001-11-01	77.0	191.0	40.0	5.5	115.857	2001	11
...	...	...	...	...	...	...	...	...
262	2023-05-01	66.0	268.0	92.0	3.7	302.566	2023	5
263	2023-06-01	70.0	266.0	93.0	3.6	304.593	2023	6
264	2023-07-01	73.0	260.0	96.0	3.5	306.767	2023	7
265	2023-08-01	75.0	258.0	97.0	3.8	309.155	2023	8
266	2023-09-01	75.0	257.0	101.0	3.8	311.175	2023	9

267 rows × 8 columns

```
In [13]: join_data_df.describe()
```

Out[13]:

	DATE	NHFSEPCS	NHFSEPUCS	NHFSEPNTS	UNRATE	CSUSHPISA	Year	Month
count	267	267.000000	267.000000	267.000000	267.000000	267.000000	267.000000	267.000000
mean	2012-07-31 17:26:17.528089856	82.262172	185.543071	54.438202	5.901124	180.684843	2012.123596	6.516854
min	2001-07-01 00:00:00	31.000000	70.000000	22.000000	3.400000	113.491000	2001.000000	1.000000
25%	2007-01-16 12:00:00	53.500000	119.500000	36.000000	4.500000	146.398500	2007.000000	4.000000
50%	2012-08-01 00:00:00	74.000000	190.000000	52.000000	5.400000	170.881000	2012.000000	7.000000
75%	2018-02-15 00:00:00	91.500000	239.000000	71.000000	6.850000	199.599000	2018.000000	9.000000
max	2023-09-01 00:00:00	194.000000	338.000000	102.000000	14.700000	311.175000	2023.000000	12.000000
std	NaN	41.981452	71.678434	23.375790	1.981597	47.838098	6.445527	3.443788

In [14]:

```
join_data_df.info()
# final_df = pd.merge(join_data_df,df_Fed_rate,on='DATE',how='inner')
#renaming column name for better understing the data & aligning Data to center(for better view data)
# final_df.
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 267 entries, 0 to 266
Data columns (total 8 columns):
 #   Column     Non-Null Count  Dtype         
---  ------     --------------  -----         
 0   DATE       267 non-null    datetime64[ns]
 1   NHFSEPCS   267 non-null    float64       
 2   NHFSEPUCS  267 non-null    float64       
 3   NHFSEPNTS  267 non-null    float64       
 4   UNRATE     267 non-null    float64       
 5   CSUSHPISA  267 non-null    float64       
 6   Year       267 non-null    int32         
 7   Month      267 non-null    int32         
dtypes: datetime64[ns](1), float64(5), int32(2)
memory usage: 14.7 KB
```

In [15]:

```
join_data_df.isnull().sum()
```

Out[15]:

```
DATE         0
NHFSEPCS     0
NHFSEPUCS    0
NHFSEPNTS    0
UNRATE       0
CSUSHPISA    0
Year         0
Month        0
dtype: int64
```

In [16]:
```
join_data_df
```

Out[16]:

	DATE	NHFSEPCS	NHFSEPUCS	NHFSEPNTS	UNRATE	CSUSHPISA	Year	Month
0	2001-07-01	76.0	186.0	43.0	4.6	113.491	2001	7
1	2001-08-01	77.0	187.0	44.0	4.9	114.167	2001	8
2	2001-09-01	79.0	191.0	40.0	5.0	114.812	2001	9
3	2001-10-01	78.0	189.0	41.0	5.3	115.310	2001	10
4	2001-11-01	77.0	191.0	40.0	5.5	115.857	2001	11
...	...	...	...	...	...	...	...	...
262	2023-05-01	66.0	268.0	92.0	3.7	302.566	2023	5
263	2023-06-01	70.0	266.0	93.0	3.6	304.593	2023	6
264	2023-07-01	73.0	260.0	96.0	3.5	306.767	2023	7
265	2023-08-01	75.0	258.0	97.0	3.8	309.155	2023	8
266	2023-09-01	75.0	257.0	101.0	3.8	311.175	2023	9

267 rows × 8 columns

In [17]:
```
join_data_df.nunique()
```

Out[17]:
```
DATE         267
NHFSEPCS     108
NHFSEPUCS    159
NHFSEPNTS     74
UNRATE        64
CSUSHPISA    267
Year          23
Month         12
dtype: int64
```

In [25]:
```
# EDA
```

In [18]:
```
join_data_df['year'] = pd.DatetimeIndex(join_data_df['DATE']).year     # Creating New columm with Year name
```

```
In [19]: join_data_df
```

```
Out[19]:
           DATE  NHFSEPCS  NHFSEPUCS  NHFSEPNTS  UNRATE  CSUSHPISA  Year  Month  year
  0  2001-07-01      76.0      186.0       43.0     4.6    113.491  2001      7  2001
  1  2001-08-01      77.0      187.0       44.0     4.9    114.167  2001      8  2001
  2  2001-09-01      79.0      191.0       40.0     5.0    114.812  2001      9  2001
  3  2001-10-01      78.0      189.0       41.0     5.3    115.310  2001     10  2001
  4  2001-11-01      77.0      191.0       40.0     5.5    115.857  2001     11  2001
...         ...       ...        ...        ...     ...        ...   ...    ...   ...
262  2023-05-01      66.0      268.0       92.0     3.7    302.566  2023      5  2023
263  2023-06-01      70.0      266.0       93.0     3.6    304.593  2023      6  2023
264  2023-07-01      73.0      260.0       96.0     3.5    306.767  2023      7  2023
265  2023-08-01      75.0      258.0       97.0     3.8    309.155  2023      8  2023
266  2023-09-01      75.0      257.0      101.0     3.8    311.175  2023      9  2023

267 rows × 9 columns
```

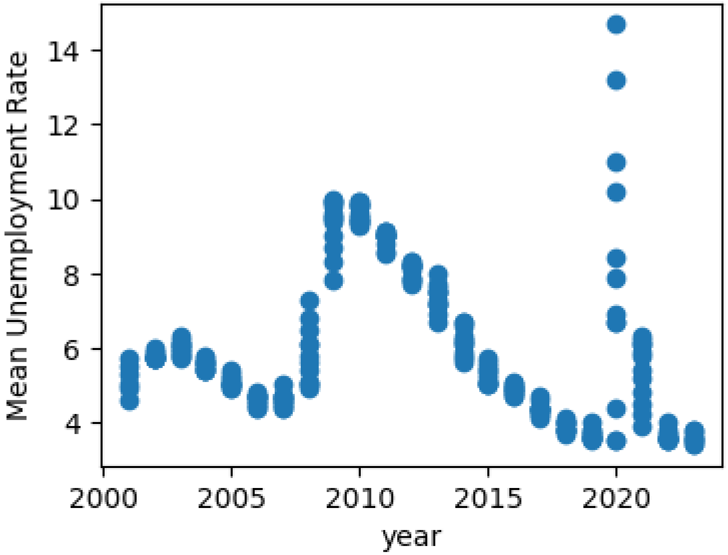
```
In [26]: join_df_mean = join_data_df.groupby(by='year', as_index=False).mean()  # Mean of the Data and group By year
         join_df_mean
```

Out[26]:

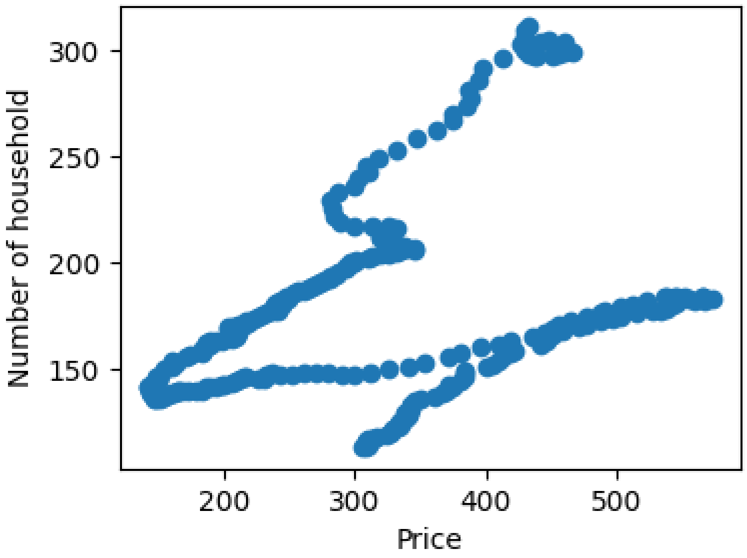
	year	DATE	NHFSEPCS	NHFSEPUCS	NHFSEPNTS	UNRATE	CSUSHPISA	Year	Month
0	2001	2001-09-15 20:00:00	77.166667	189.000000	41.666667	5.166667	115.015333	2001.0	9.5
1	2002	2002-06-16 12:00:00	82.500000	199.000000	46.000000	5.783333	122.279250	2002.0	6.5
2	2003	2003-06-16 12:00:00	80.833333	213.916667	53.666667	5.991667	133.731333	2003.0	6.5
3	2004	2004-06-16 08:00:00	89.916667	243.250000	62.166667	5.541667	150.440250	2004.0	6.5
4	2005	2005-06-16 12:00:00	106.750000	279.500000	81.416667	5.083333	171.737000	2005.0	6.5
5	2006	2006-06-16 12:00:00	144.083333	318.166667	91.083333	4.608333	183.447500	2006.0	6.5
6	2007	2007-06-16 12:00:00	185.416667	267.166667	78.500000	4.616667	179.918917	2007.0	6.5
7	2008	2008-06-16 08:00:00	179.083333	190.416667	56.000000	5.800000	164.057417	2008.0	6.5
8	2009	2009-06-16 12:00:00	128.000000	115.750000	35.083333	9.283333	148.545083	2009.0	6.5
9	2010	2010-06-16 12:00:00	86.500000	97.083333	27.750000	9.608333	144.674500	2010.0	6.5
10	2011	2011-06-16 12:00:00	65.500000	77.166667	24.666667	8.933333	139.259500	2011.0	6.5
11	2012	2012-06-16 08:00:00	44.500000	77.750000	23.583333	8.075000	140.993833	2012.0	6.5
12	2013	2013-06-16 12:00:00	40.000000	99.083333	29.500000	7.358333	154.520750	2013.0	6.5
13	2014	2014-06-16 12:00:00	50.250000	117.750000	32.250000	6.158333	164.698167	2014.0	6.5
14	2015	2015-06-16 12:00:00	51.583333	127.333333	37.166667	5.275000	172.181750	2015.0	6.5
15	2016	2016-06-16 08:00:00	58.333333	146.583333	38.083333	4.875000	180.925500	2016.0	6.5
16	2017	2017-06-16 12:00:00	62.250000	165.500000	47.416667	4.358333	191.397667	2017.0	6.5
17	2018	2018-06-16 12:00:00	66.500000	191.083333	56.166667	3.891667	202.476417	2018.0	6.5
18	2019	2019-06-16 12:00:00	77.500000	198.166667	54.666667	3.683333	209.463333	2019.0	6.5
19	2020	2020-06-16 08:00:00	60.583333	184.166667	59.083333	8.091667	222.143417	2020.0	6.5
20	2021	2021-06-16 12:00:00	34.416667	225.250000	89.500000	5.366667	260.045667	2021.0	6.5
21	2022	2022-06-16 12:00:00	44.333333	298.666667	96.833333	3.641667	298.486750	2022.0	6.5
22	2023	2023-05-01 18:40:00	70.555556	268.111111	93.111111	3.588889	303.074778	2023.0	5.0

In [30]:

```
plt.figure(figsize=(4,3))
plt.scatter(join_data_df.year,join_data_df.UNRATE)
plt.xlabel('year')
plt.ylabel('Mean Unemployment Rate')
plt.show()
```

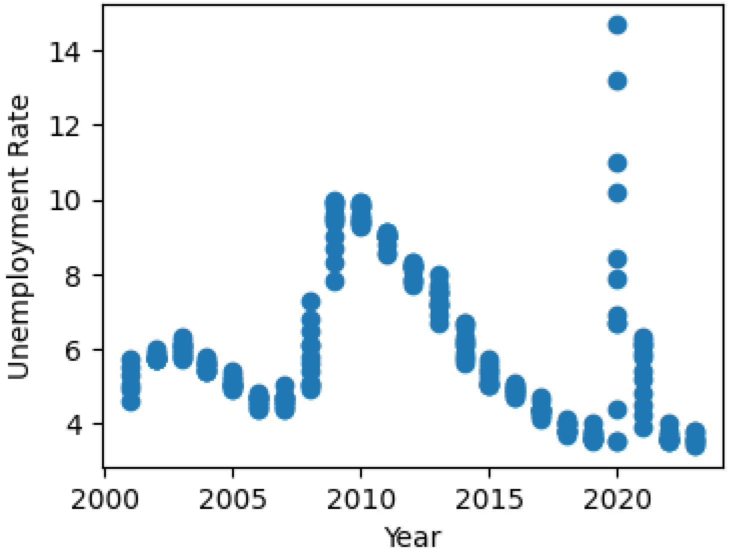


In [54]:
```
# Price VS Number of houses
plt.figure(figsize=(4,3))
plt.scatter(data_df_new.Num_Households,data_df_new.Price_fact)
plt.xlabel('Price')
plt.ylabel('Number of household')
plt.show()
```

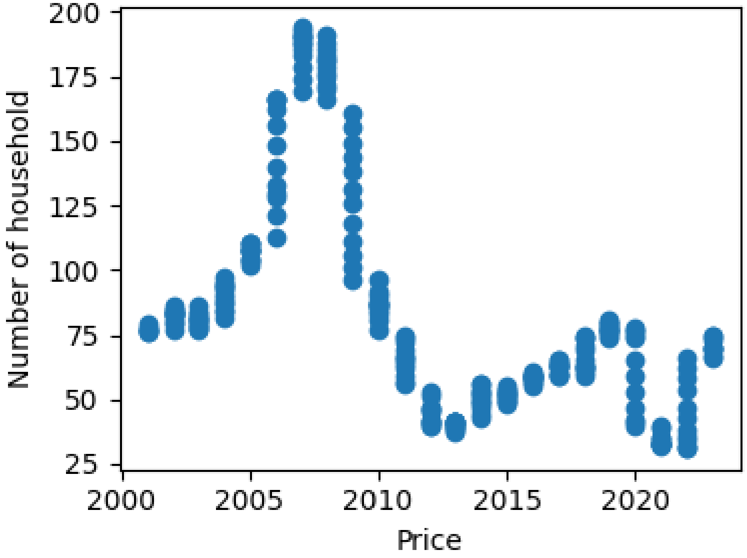


In [55]:

```
# Year Vs Unemployement in US
plt.figure(figsize=(4,3))
plt.scatter(join_data_df.year,join_data_df.UNRATE)
plt.xlabel('Year')
plt.ylabel('Unemployment Rate')
plt.show()
```



```
In [56]: # Year VS Construction completed
         plt.figure(figsize=(4,3))
         plt.scatter(data_df_new.Year,data_df_new.Const_complt)
         plt.xlabel('Price')
         plt.ylabel('Number of household')
         plt.show()
```



In [31]:
```
# Total number of houses for sale
# Link :- https://fred.stlouisfed.org/series/HNFSEPUSSA/
data_new = pd.read_csv("number_of_houses.csv", names = ["DATE", "Num_Households"], skiprows = 1)
# data_new=pd.read_csv('HNFSEPUSSA.csv')  # Total number of houses for sale
data_new.head(12)
```

Out[31]:

	DATE	Num_Households
0	2001-07-01	305.0
1	2001-08-01	308.0
2	2001-09-01	310.0
3	2001-10-01	308.0
4	2001-11-01	308.0
5	2001-12-01	308.0
6	2002-01-01	310.0
7	2002-02-01	313.0
8	2002-03-01	316.0
9	2002-04-01	324.0
10	2002-05-01	327.0
11	2002-06-01	328.0

In [ ]:

In [32]:
```
data_new['year']=  pd.DatetimeIndex(data_new['DATE']).year
```

In [ ]:

In [36]:
```
join_data_df.dtypes
```

Out[36]:
```
DATE         datetime64[ns]
NHFSEPCS            float64
NHFSEPUCS           float64
NHFSEPNTS           float64
UNRATE              float64
CSUSHPISA           float64
Year                  int32
Month                 int32
year                  int32
dtype: object
```

In [37]:
```
data_new.dtypes
```

Out[37]:
```
DATE               object
Num_Households    float64
year                int32
dtype: object
```

In [38]:
```
data_new["DATE"] = pd.to_datetime(data_new["DATE"])
```

In [39]:
```
data_new.dtypes
# join_data_df.corr()
```

Out[39]:
```
DATE              datetime64[ns]
Num_Households           float64
year                       int32
dtype: object
```

In [40]:
```
data_df_new=pd.merge(data_new,join_data_df,on='DATE',how ='inner')
```

```
In [41]: data_df_new
```

```
Out[41]:
           DATE  Num_Households  year_x  NHFSEPCS  NHFSEPUCS  NHFSEPNTS  UNRATE  CSUSHPISA  Year  Month  year_y
  0  2001-07-01           305.0    2001      76.0      186.0       43.0     4.6    113.491  2001      7    2001
  1  2001-08-01           308.0    2001      77.0      187.0       44.0     4.9    114.167  2001      8    2001
  2  2001-09-01           310.0    2001      79.0      191.0       40.0     5.0    114.812  2001      9    2001
  3  2001-10-01           308.0    2001      78.0      189.0       41.0     5.3    115.310  2001     10    2001
  4  2001-11-01           308.0    2001      77.0      191.0       40.0     5.5    115.857  2001     11    2001
...         ...             ...     ...       ...        ...        ...     ...        ...   ...    ...     ...
262  2023-05-01           426.0    2023      66.0      268.0       92.0     3.7    302.566  2023      5    2023
263  2023-06-01           429.0    2023      70.0      266.0       93.0     3.6    304.593  2023      6    2023
264  2023-07-01           429.0    2023      73.0      260.0       96.0     3.5    306.767  2023      7    2023
265  2023-08-01           430.0    2023      75.0      258.0       97.0     3.8    309.155  2023      8    2023
266  2023-09-01           433.0    2023      75.0      257.0      101.0     3.8    311.175  2023      9    2023

267 rows × 11 columns
```

```
In [42]: data_df_new.rename(columns = {'NHFSEPCS':'Const_complt',
                                       'NHFSEPUCS':'un_constr',
                                       'NHFSEPNTS':'Cnstr_not_Strtd',
                                        'U2RATE':'Unemploy_Rate',
                                       'CSUSHPISA':'Price_fact',
                                       'FEDFUNDS':'Interest'}, inplace = True)
```

```
In [43]: data_df_new
```

Out[43]:

	DATE	Num_Households	year_x	Const_complt	un_constr	Cnstr_not_Strtd	UNRATE	Price_fact	Year	Month	year_y
0	2001-07-01	305.0	2001	76.0	186.0	43.0	4.6	113.491	2001	7	2001
1	2001-08-01	308.0	2001	77.0	187.0	44.0	4.9	114.167	2001	8	2001
2	2001-09-01	310.0	2001	79.0	191.0	40.0	5.0	114.812	2001	9	2001
3	2001-10-01	308.0	2001	78.0	189.0	41.0	5.3	115.310	2001	10	2001
4	2001-11-01	308.0	2001	77.0	191.0	40.0	5.5	115.857	2001	11	2001
...	...	...	...	...	...	...	...	...	...	...	...
262	2023-05-01	426.0	2023	66.0	268.0	92.0	3.7	302.566	2023	5	2023
263	2023-06-01	429.0	2023	70.0	266.0	93.0	3.6	304.593	2023	6	2023
264	2023-07-01	429.0	2023	73.0	260.0	96.0	3.5	306.767	2023	7	2023
265	2023-08-01	430.0	2023	75.0	258.0	97.0	3.8	309.155	2023	8	2023
266	2023-09-01	433.0	2023	75.0	257.0	101.0	3.8	311.175	2023	9	2023

267 rows × 11 columns

In [44]:

```
ta_df_new=data_df_new.drop(columns=['year_x','year_y'],axis=1)

data_df_new=data_df_new.drop(columns=['year_x','year_y','Const_complt','un_constr','Cnstr_not_Strtd','Year','Month']
ta_df_new
```

Out[44]:

	DATE	Num_Households	Const_complt	un_constr	Cnstr_not_Strtd	UNRATE	Price_fact	Year	Month
0	2001-07-01	305.0	76.0	186.0	43.0	4.6	113.491	2001	7
1	2001-08-01	308.0	77.0	187.0	44.0	4.9	114.167	2001	8
2	2001-09-01	310.0	79.0	191.0	40.0	5.0	114.812	2001	9
3	2001-10-01	308.0	78.0	189.0	41.0	5.3	115.310	2001	10
4	2001-11-01	308.0	77.0	191.0	40.0	5.5	115.857	2001	11
...	...	...	...	...	...	...	...	...	...
262	2023-05-01	426.0	66.0	268.0	92.0	3.7	302.566	2023	5
263	2023-06-01	429.0	70.0	266.0	93.0	3.6	304.593	2023	6
264	2023-07-01	429.0	73.0	260.0	96.0	3.5	306.767	2023	7
265	2023-08-01	430.0	75.0	258.0	97.0	3.8	309.155	2023	8
266	2023-09-01	433.0	75.0	257.0	101.0	3.8	311.175	2023	9

267 rows × 9 columns

In [45]:

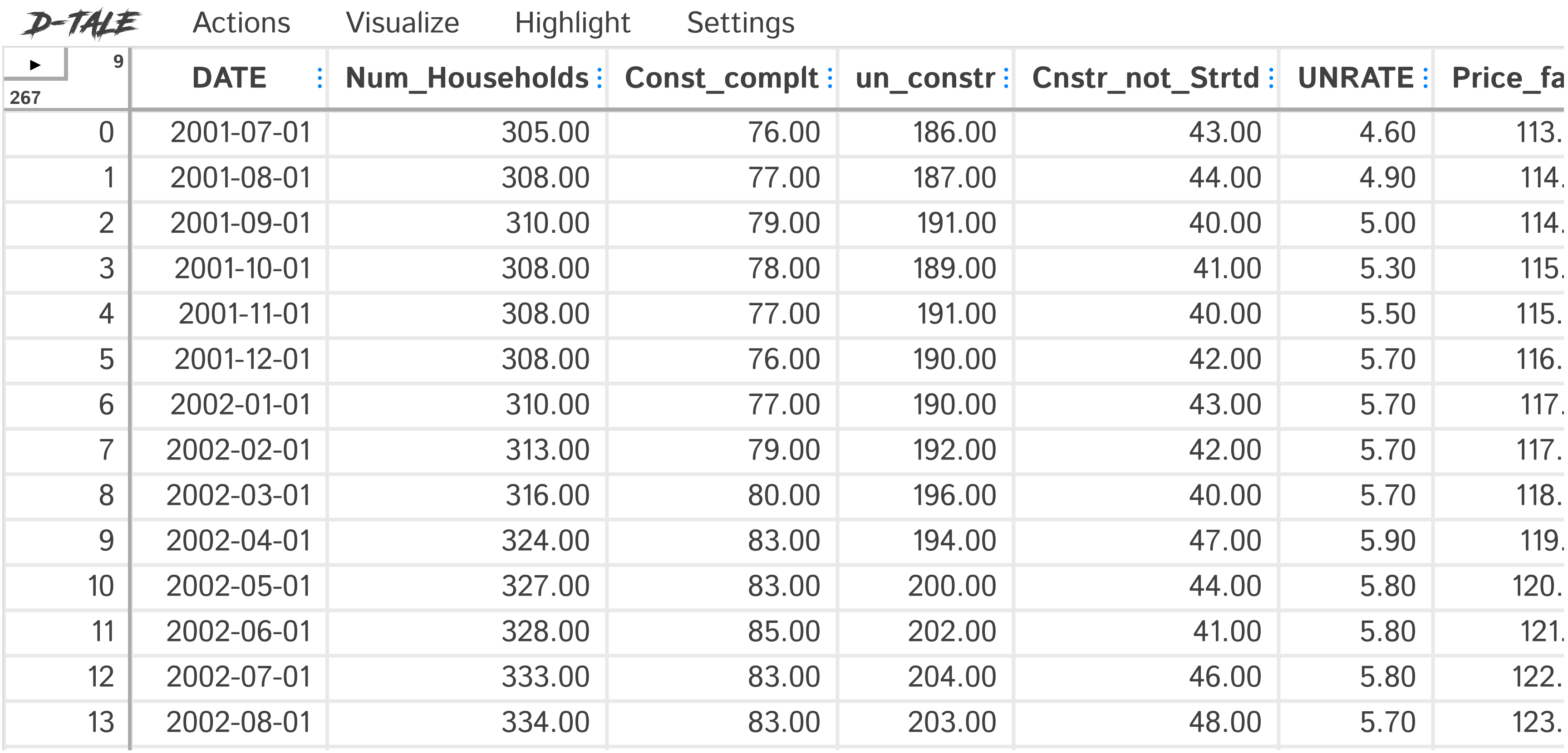
```
data_df_mean = data_df_new.groupby(by='Year', as_index=False).mean()  # Mean of the Data and group By year
data_df_mean
```

Out[45]:

```
    Year                 DATE  Num_Households  Const_complt   un_constr  Cnstr_not_Strtd    UNRATE  Price_fact  Month
 0  2001  2001-09-15 20:00:00      307.833333     77.166667  189.000000        41.666667  5.166667  115.015333    9.5
 1  2002  2002-06-16 12:00:00      327.500000     82.500000  199.000000        46.000000  5.783333  122.279250    6.5
 2  2003  2003-06-16 12:00:00      348.416667     80.833333  213.916667        53.666667  5.991667  133.731333    6.5
 3  2004  2004-06-16 08:00:00      395.333333     89.916667  243.250000        62.166667  5.541667  150.440250    6.5
 4  2005  2005-06-16 12:00:00      467.666667    106.750000  279.500000        81.416667  5.083333  171.737000    6.5
 5  2006  2006-06-16 12:00:00      553.333333    144.083333  318.166667        91.083333  4.608333  183.447500    6.5
 6  2007  2007-06-16 12:00:00      531.083333    185.416667  267.166667        78.500000  4.616667  179.918917    6.5
 7  2008  2008-06-16 08:00:00      425.500000    179.083333  190.416667        56.000000  5.800000  164.057417    6.5
 8  2009  2009-06-16 12:00:00      278.833333    128.000000  115.750000        35.083333  9.283333  148.545083    6.5
 9  2010  2010-06-16 12:00:00      211.333333     86.500000   97.083333        27.750000  9.608333  144.674500    6.5
10  2011  2011-06-16 12:00:00      167.333333     65.500000   77.166667        24.666667  8.933333  139.259500    6.5
11  2012  2012-06-16 08:00:00      145.833333     44.500000   77.750000        23.583333  8.075000  140.993833    6.5
12  2013  2013-06-16 12:00:00      168.583333     40.000000   99.083333        29.500000  7.358333  154.520750    6.5
13  2014  2014-06-16 12:00:00      200.250000     50.250000  117.750000        32.250000  6.158333  164.698167    6.5
14  2015  2015-06-16 12:00:00      216.083333     51.583333  127.333333        37.166667  5.275000  172.181750    6.5
15  2016  2016-06-16 08:00:00      243.000000     58.333333  146.583333        38.083333  4.875000  180.925500    6.5
16  2017  2017-06-16 12:00:00      275.166667     62.250000  165.500000        47.416667  4.358333  191.397667    6.5
17  2018  2018-06-16 12:00:00      313.750000     66.500000  191.083333        56.166667  3.891667  202.476417    6.5
18  2019  2019-06-16 12:00:00      330.333333     77.500000  198.166667        54.666667  3.683333  209.463333    6.5
19  2020  2020-06-16 08:00:00      303.833333     60.583333  184.166667        59.083333  8.091667  222.143417    6.5
20  2021  2021-06-16 12:00:00      349.166667     34.416667  225.250000        89.500000  5.366667  260.045667    6.5
21  2022  2022-06-16 12:00:00      439.833333     44.333333  298.666667        96.833333  3.641667  298.486750    6.5
22  2023  2023-05-01 18:40:00      431.777778     70.555556  268.111111        93.111111  3.588889  303.074778    5.0
```

```
In [46]: # EDA Using Dtale Librery
```

```
In [47]: import dtale
         dtale.show(data_df_new)
```



	DATE	Num_Households	Const_complt	un_constr	Cnstr_not_Strtd	UNRATE	Price_fa
0	2001-07-01	305.00	76.00	186.00	43.00	4.60	113.
1	2001-08-01	308.00	77.00	187.00	44.00	4.90	114.
2	2001-09-01	310.00	79.00	191.00	40.00	5.00	114.
3	2001-10-01	308.00	78.00	189.00	41.00	5.30	115.
4	2001-11-01	308.00	77.00	191.00	40.00	5.50	115.
5	2001-12-01	308.00	76.00	190.00	42.00	5.70	116.
6	2002-01-01	310.00	77.00	190.00	43.00	5.70	117.
7	2002-02-01	313.00	79.00	192.00	42.00	5.70	117.
8	2002-03-01	316.00	80.00	196.00	40.00	5.70	118.
9	2002-04-01	324.00	83.00	194.00	47.00	5.90	119.
10	2002-05-01	327.00	83.00	200.00	44.00	5.80	120.
11	2002-06-01	328.00	85.00	202.00	41.00	5.80	121.
12	2002-07-01	333.00	83.00	204.00	46.00	5.80	122.
13	2002-08-01	334.00	83.00	203.00	48.00	5.70	123.

```
Out[47]:
```

```
In [ ]: # data_df_new.to_csv("Final_USHousing_DataSet.csv")
```

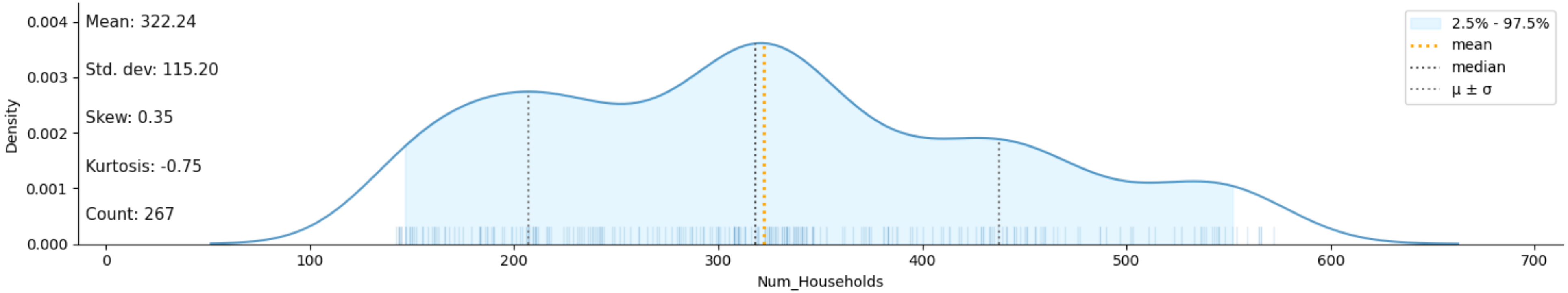
```
In [48]: import klib
```

```
In [49]: klib.missingval_plot(data_df_new) # returns a figure containing information about missing values

         No missing values found in the dataset.
```

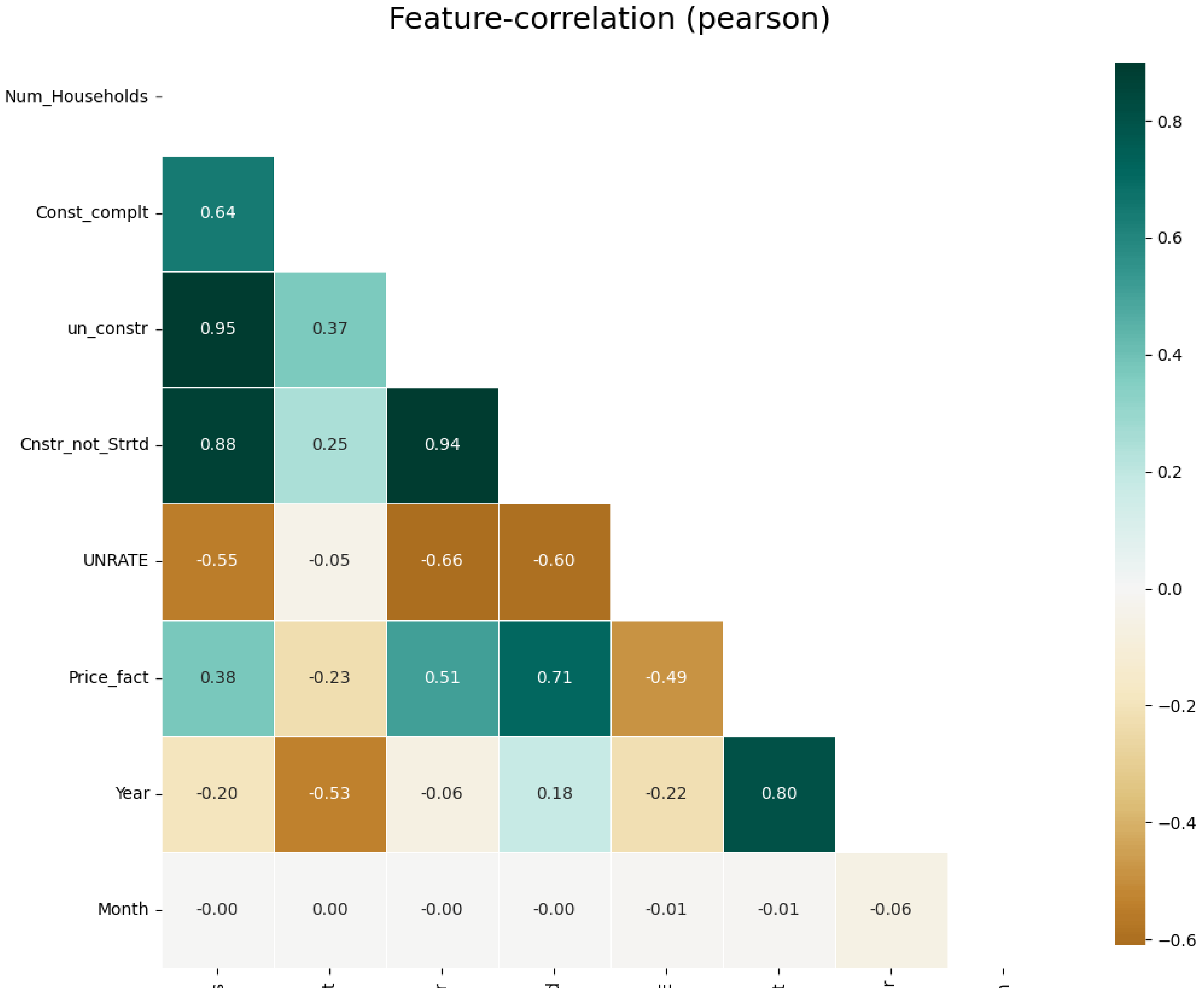
```
In [50]: klib.dist_plot(data_df_new) # returns a distribution plot for every numeric feature
```

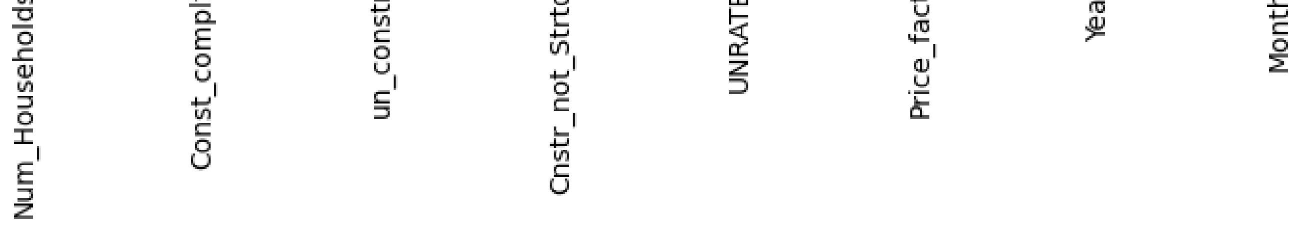
```
Out[50]: <Axes: xlabel='Num_Households', ylabel='Density'>
```



```
In [51]: klib.corr_plot(data_df_new)
```

```
Out[51]: <Axes: title={'center': 'Feature-correlation (pearson)'}>
```


Feature-correlation (pearson)
Num_Households
Const_complt
un_constr
Cnstr_not_Strtd
UNRATE
Price_fact
Year
Month
0.64
0.95
0.37
0.88
0.25
0.94
-0.55
-0.05
-0.66
-0.60
0.38
-0.23
0.51
0.71
-0.49
-0.20
-0.53
-0.06
0.18
-0.22
0.80
-0.00
0.00
-0.00
-0.00
-0.01
-0.01
-0.06
0.8
0.6
0.4
0.2
0.0
−0.2
−0.4
−0.6



In [52]:
```
klib.corr_mat(data_df_new)
```

Out[52]:

	Num_Households	Const_complt	un_constr	Cnstr_not_Strtd	UNRATE	Price_fact	Year	Month
Num_Households	1.00	0.64	0.95	0.88	-0.55	0.38	-0.20	-0.00
Const_complt	0.64	1.00	0.37	0.25	-0.05	-0.23	-0.53	0.00
un_constr	0.95	0.37	1.00	0.94	-0.66	0.51	-0.06	-0.00
Cnstr_not_Strtd	0.88	0.25	0.94	1.00	-0.60	0.71	0.18	-0.00
UNRATE	-0.55	-0.05	-0.66	-0.60	1.00	-0.49	-0.22	-0.01
Price_fact	0.38	-0.23	0.51	0.71	-0.49	1.00	0.80	-0.01
Year	-0.20	-0.53	-0.06	0.18	-0.22	0.80	1.00	-0.06
Month	-0.00	0.00	-0.00	-0.00	-0.01	-0.01	-0.06	1.00

Exploratory Data Analysis

In [ ]:

In [ ]:

In [ ]:

In [57]:
```
# !pip install -U notebook-as-pdf
# !pyppeteer-install
```

In [ ]:

```
In [ ]:
```