In [1]:

```
import numpy as np
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
from sklearn import preprocessing, svm
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LinearRegression
```

In [2]:

```
dt=pd.read_csv(r"C:\Users\HP\Downloads\data.csv")
dt
```

Out[2]:

	date	price	bedrooms	bathrooms	sqft_living	sqft_lot	floors	waterfront	v
0	2014-05-02 00:00:00	3.130000e+05	3.0	1.50	1340	7912	1.5	0	
1	2014-05-02 00:00:00	2.384000e+06	5.0	2.50	3650	9050	2.0	0	
2	2014-05-02 00:00:00	3.420000e+05	3.0	2.00	1930	11947	1.0	0	
3	2014-05-02 00:00:00	4.200000e+05	3.0	2.25	2000	8030	1.0	0	
4	2014-05-02 00:00:00	5.500000e+05	4.0	2.50	1940	10500	1.0	0	
...	...	...	...	...	...	...	...	...	
4595	2014-07-09 00:00:00	3.081667e+05	3.0	1.75	1510	6360	1.0	0	
4596	2014-07-09 00:00:00	5.343333e+05	3.0	2.50	1460	7573	2.0	0	
4597	2014-07-09 00:00:00	4.169042e+05	3.0	2.50	3010	7014	2.0	0	
4598	2014-07-10 00:00:00	2.034000e+05	4.0	2.00	2090	6630	1.0	0	
4599	2014-07-10 00:00:00	2.206000e+05	3.0	2.50	1490	8102	2.0	0	

4600 rows × 18 columns

In [3]:

```
dt=dt[['sqft_living','sqft_lot']]
dt.columns=['Liv','Lot']
```

In [4]:

```
dt.head(10)
```

Out[4]:

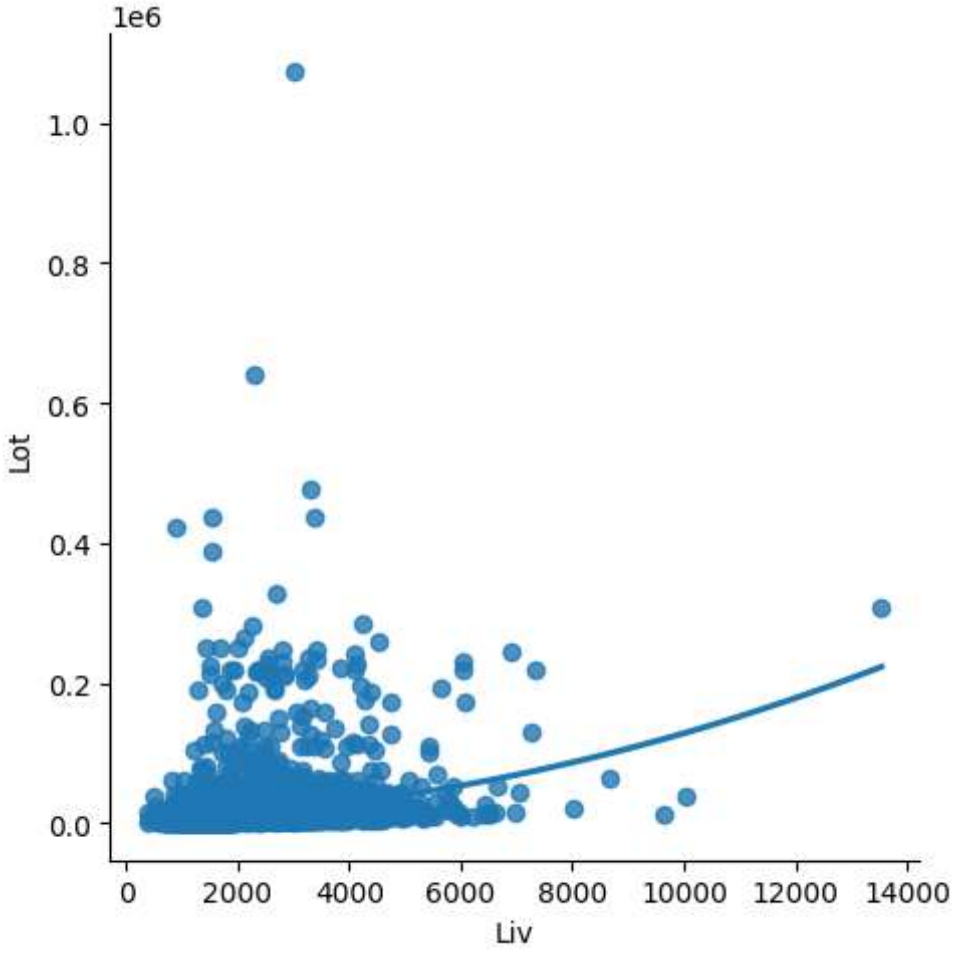
	Liv	Lot
0	1340	7912
1	3650	9050
2	1930	11947
3	2000	8030
4	1940	10500
5	880	6380
6	1350	2560
7	2710	35868
8	2430	88426
9	1520	6200

In [5]:

```
1 sns.lmplot(x='Liv',y='Lot',data=dt,order=2,ci=None)
```

Out[5]:

```
<seaborn.axisgrid.FacetGrid at 0x160d1b52b50>
```



In [6]:

```
1 dt.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 4600 entries, 0 to 4599
Data columns (total 2 columns):
 #   Column  Non-Null Count  Dtype
---  ------  --------------  -----
 0   Liv     4600 non-null   int64
 1   Lot     4600 non-null   int64
dtypes: int64(2)
memory usage: 72.0 KB
```

In [7]:

```
1 dt.describe()
```

Out[7]:

	Liv	Lot
count	4600.000000	4.600000e+03
mean	2139.346957	1.485252e+04
std	963.206916	3.588444e+04
min	370.000000	6.380000e+02
25%	1460.000000	5.000750e+03
50%	1980.000000	7.683000e+03
75%	2620.000000	1.100125e+04
max	13540.000000	1.074218e+06

In [8]:

```
1 dt.fillna(method='ffill')
```

Out[8]:

	Liv	Lot
0	1340	7912
1	3650	9050
2	1930	11947
3	2000	8030
4	1940	10500
...	...	...
4595	1510	6360
4596	1460	7573
4597	3010	7014
4598	2090	6630
4599	1490	8102

4600 rows × 2 columns

In [9]:

```
1 x=np.array(dt['Liv']).reshape(-1,1)
2 y=np.array(dt['Lot']).reshape(-1,1)
```

In [10]:

```
dt.dropna(inplace=True)
```

```
C:\Users\HP\AppData\Local\Temp\ipykernel_10920\735218168.py:1: SettingWith
CopyWarning:
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-doc
s/stable/user_guide/indexing.html#returning-a-view-versus-a-copy (https://
pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-
view-versus-a-copy)
  dt.dropna(inplace=True)
```

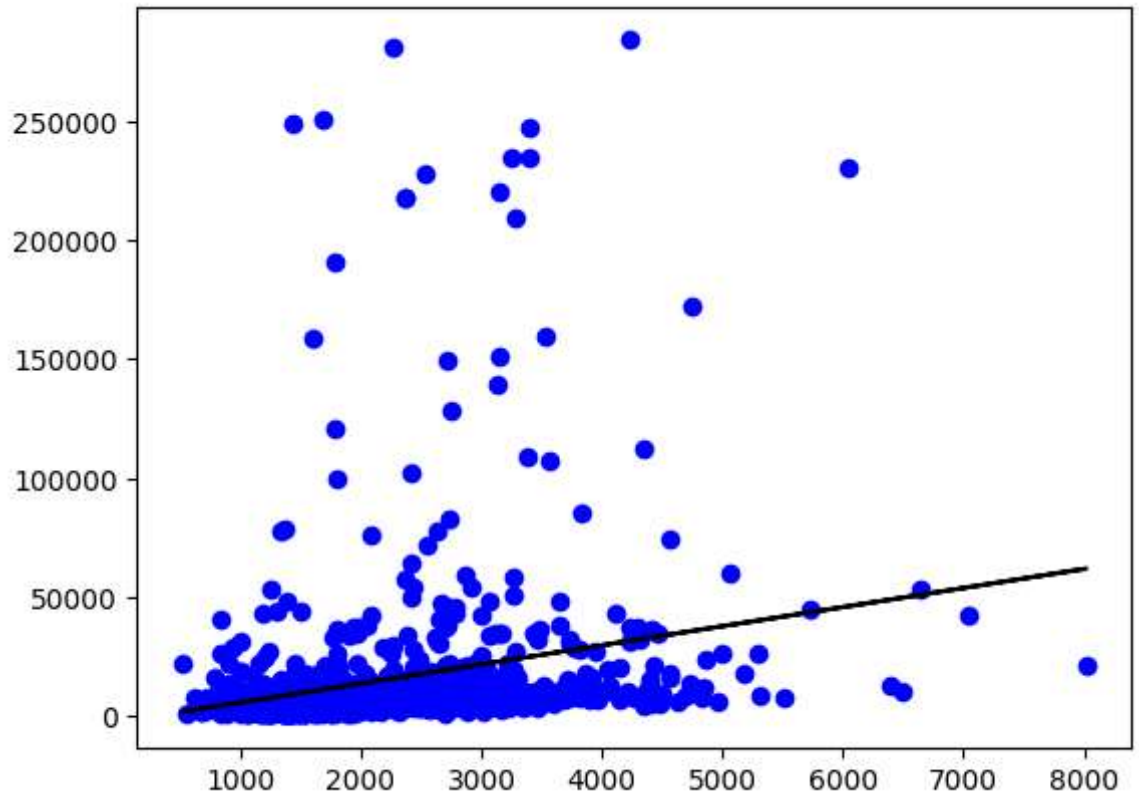
In [11]:

```
X_train,X_test,y_train,y_test=train_test_split(x,y,test_size=0.25)
reg=LinearRegression()
reg.fit(X_train,y_train)
print(reg.score(X_test,y_test))
```

```
0.052631207637805266
```

In [12]:

```
y_pred=reg.predict(X_test)
plt.scatter(X_test,y_test,color='b')
plt.plot(X_test,y_pred,color='k')
plt.show()
```

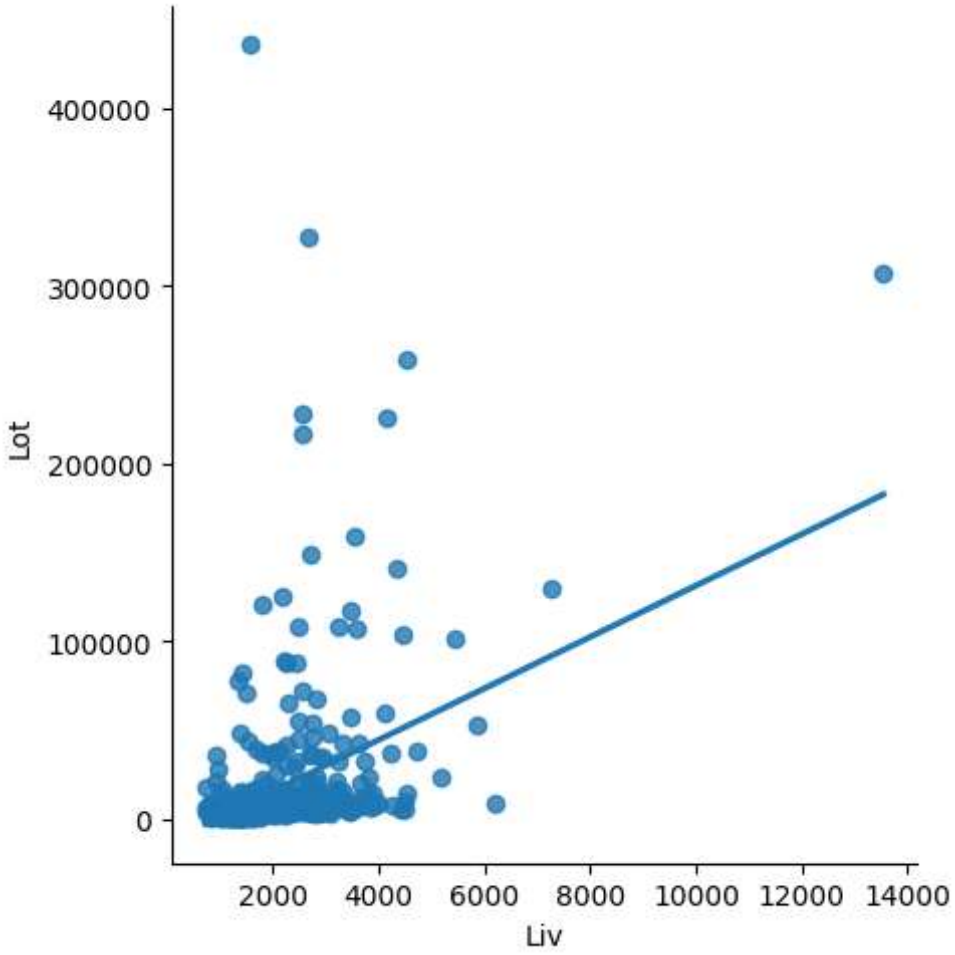


In [13]:

```
1 dt500=dt[:][:500]
2 sns.lmplot(x="Liv",y="Lot",data=dt500,order=1,ci=None)
```

Out[13]:

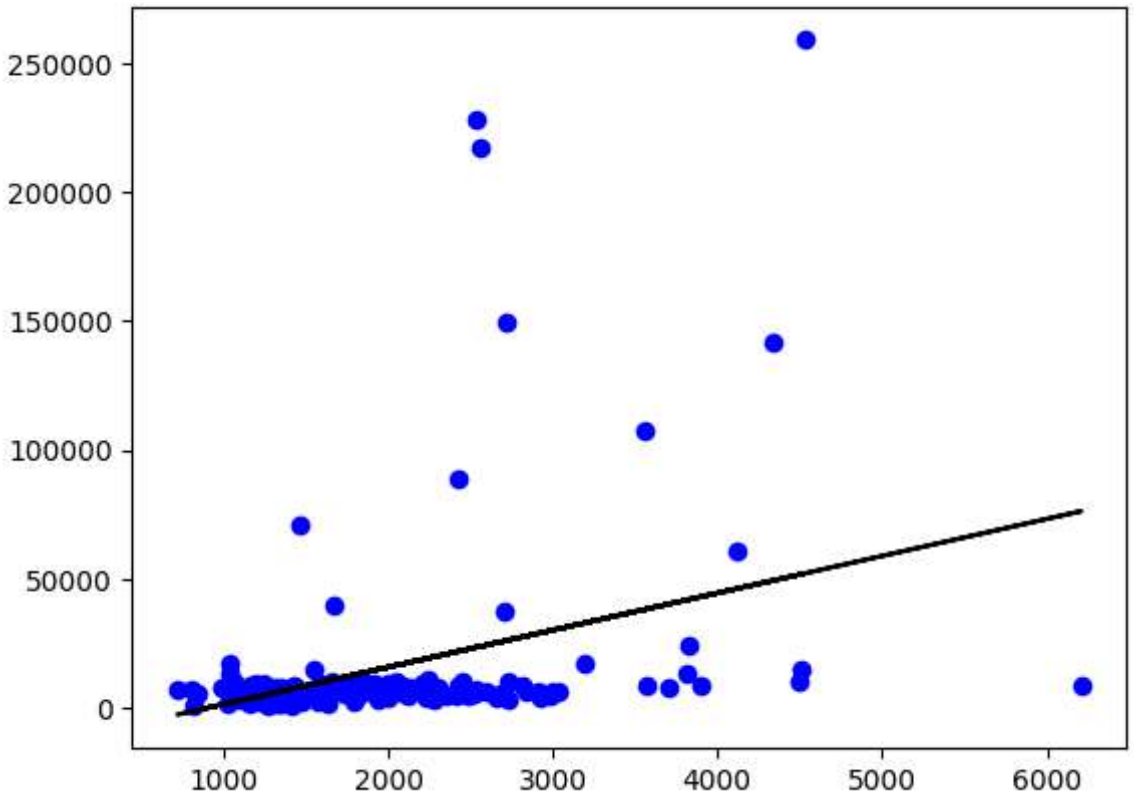
```
<seaborn.axisgrid.FacetGrid at 0x160c688ce90>
```



In [14]:

```
dt500.fillna(method='ffill',inplace=True)
X=np.array(dt500['Liv']).reshape(-1,1)
y=np.array(dt500['Lot']).reshape(-1,1)
dt500.dropna(inplace=True)
X_train,X_test,y_train,y_test=train_test_split(X,y,test_size=0.25)
reg=LinearRegression()
reg.fit(X_train,y_train)
print("Regression:",reg.score(X_test,y_test))
y_pred=reg.predict(X_test)
plt.scatter(X_test,y_test,color="b")
plt.plot(X_test,y_pred,color='k')
plt.show()
```

```
Regression: 0.11324919943741196
```



In [15]:

```
from sklearn.linear_model import LinearRegression
from sklearn.metrics import r2_score
mode1=LinearRegression()
mode1.fit(X_train,y_train)
y_pred=mode1.predict(X_test)
r2=r2_score(y_test,y_pred)
print("R2 score:",r2)
```

```
R2 score: 0.11324919943741196
```

In [16]:

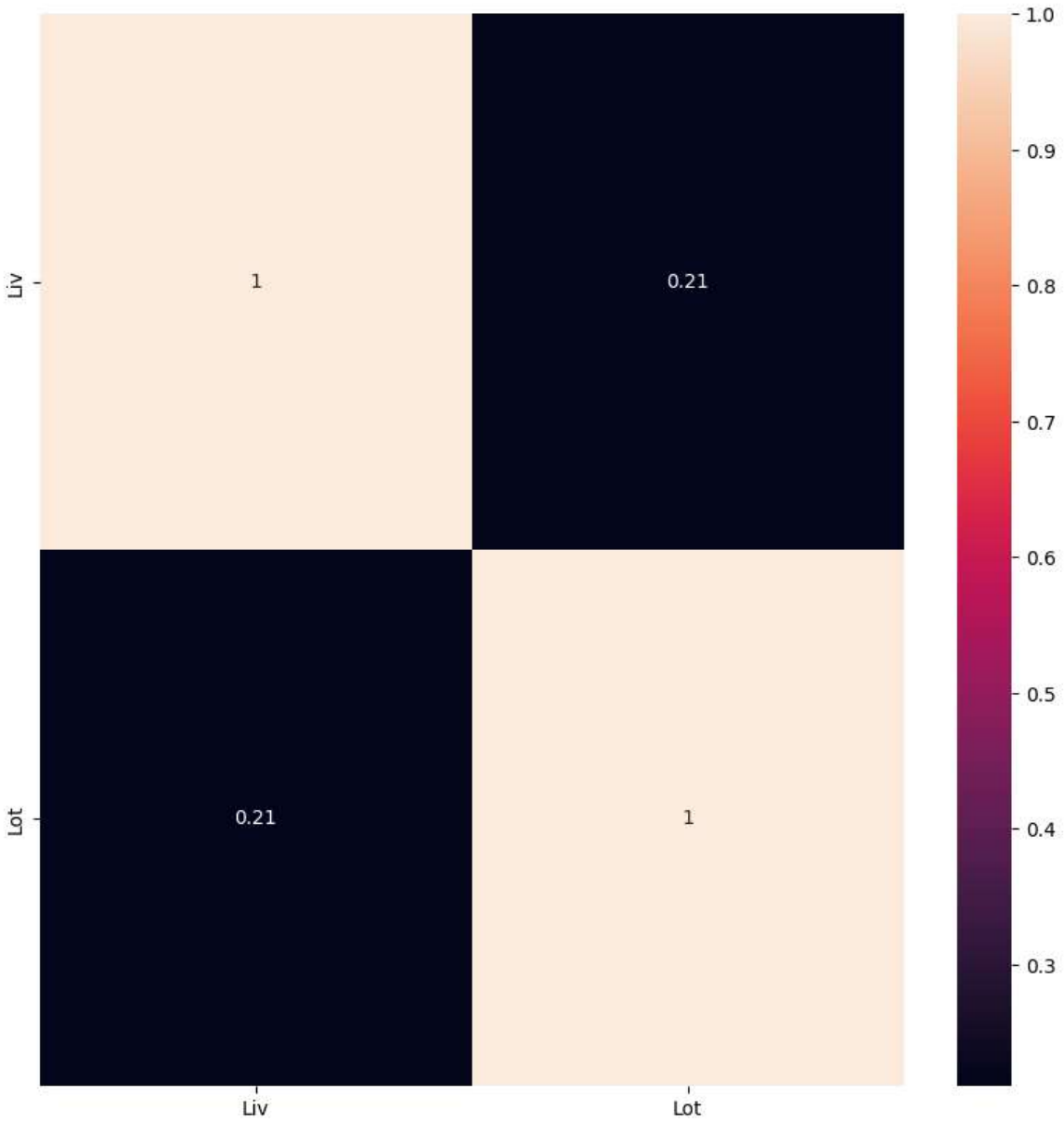
```
from sklearn.linear_model import Ridge, RidgeCV, Lasso
from sklearn.preprocessing import StandardScaler
```

In [17]:

```
plt.figure(figsize = (10, 10))
sns.heatmap(dt.corr(), annot = True)

```

Out[17]:

<Axes: >



In [18]:

```
features = dt.columns[0:2]
target = dt.columns[-1]
#X and y values
X = dt[features].values
y = dt[target].values
#splot
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.3, random_state
print("The dimension of X_train is {}".format(X_train.shape))
print("The dimension of X_test is {}".format(X_test.shape))
#Scale features
scaler = StandardScaler()
X_train = scaler.fit_transform(X_train)
X_test = scaler.transform(X_test)

```

```
The dimension of X_train is (3220, 2)
The dimension of X_test is (1380, 2)
```

In [19]:

```
#Model
lr = LinearRegression()
#Fit model
lr.fit(X_train, y_train)
#predict
#prediction = lr.predict(X_test)
#actual
actual = y_test
train_score_lr = lr.score(X_train, y_train)
test_score_lr = lr.score(X_test, y_test)
print("\nLinear Regression Model:\n")
print("The train score for lr model is {}".format(train_score_lr))
print("The test score for lr model is {}".format(test_score_lr))
```

```
Linear Regression Model:

The train score for lr model is 1.0
The test score for lr model is 1.0
```

In [20]:

```
#Model
lr = LinearRegression()
#Fit model
lr.fit(X_train, y_train)
#predict
#prediction = lr.predict(X_test)
#actual
actual = y_test
train_score_lr = lr.score(X_train, y_train)
test_score_lr = lr.score(X_test, y_test)
print("\nLinear Regression Model:\n")
print("The train score for lr model is {}".format(train_score_lr))
print("The test score for lr model is {}".format(test_score_lr))
```

```
Linear Regression Model:

The train score for lr model is 1.0
The test score for lr model is 1.0
```

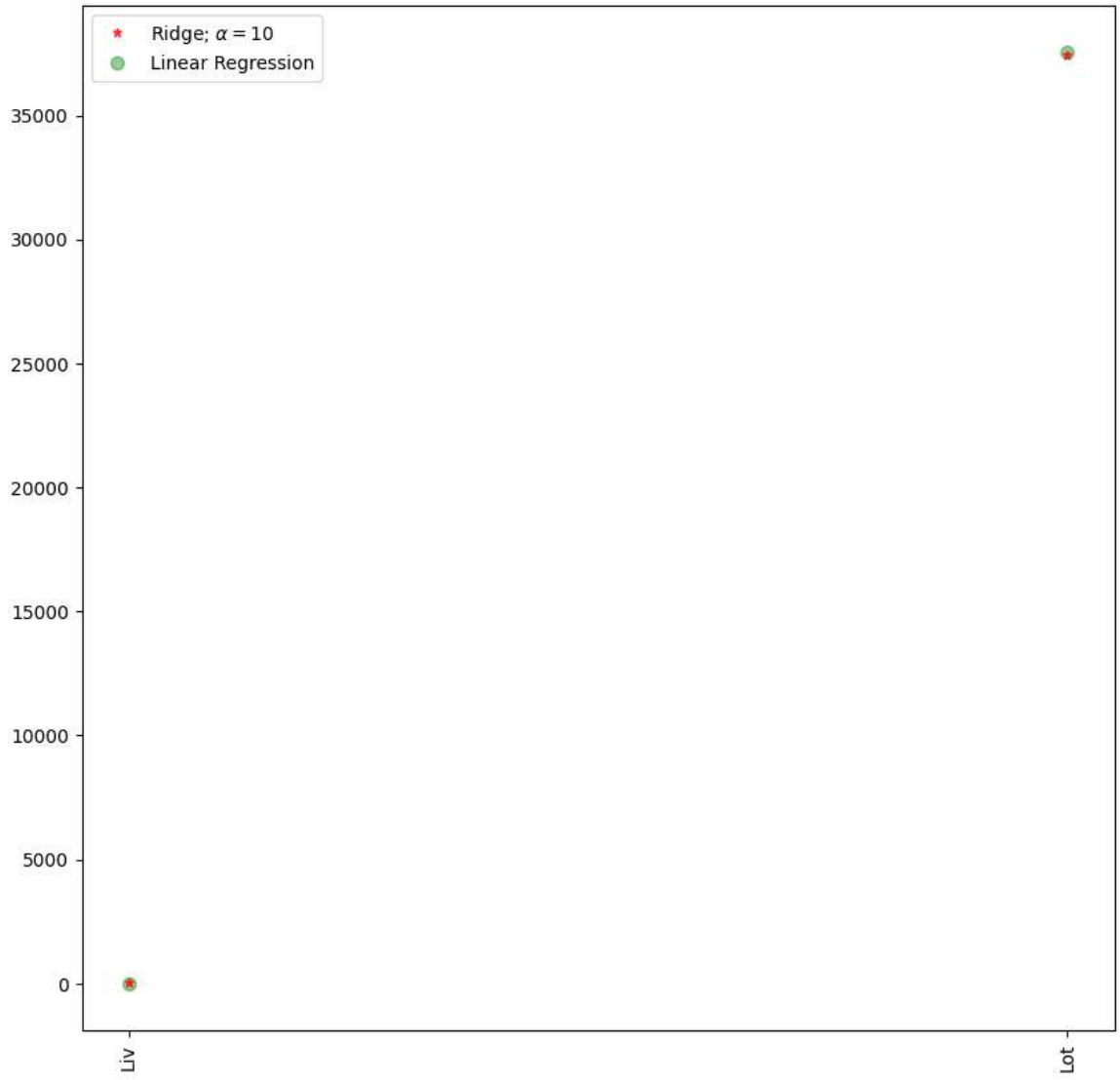
In [21]:

```
#Ridge Regression Model
ridgeReg = Ridge(alpha=10)
ridgeReg.fit(X_train,y_train)
#train and test scorefor ridge regression
train_score_ridge = ridgeReg.score(X_train, y_train)
test_score_ridge = ridgeReg.score(X_test, y_test)
print("\nRidge Model:\n")
print("The train score for ridge model is {}".format(train_score_ridge))
print("The test score for ridge model is {}".format(test_score_ridge))

```

```
Ridge Model:

The train score for ridge model is 0.9999900245012017
The test score for ridge model is 0.9999902306741419
```

In [22]:

```
plt.figure(figsize = (10, 10))
plt.plot(features,ridgeReg.coef_,alpha=0.7,linestyle='none',marker='*',markersize=5,c
#plt.plot(rr100.coef_,alpha=0.5,linestyle='none',marker='d',markersize=6,color='blue
plt.plot(features,lr.coef_,alpha=0.4,linestyle='none',marker='o',markersize=7,color='
plt.xticks(rotation = 90)
plt.legend()
plt.show()
```



In [23]:

```
#Lasso regression model
print("\nLasso Model: \n")
lasso = Lasso(alpha = 10)
lasso.fit(X_train,y_train)
train_score_ls =lasso.score(X_train,y_train)
test_score_ls =lasso.score(X_test,y_test)
print("The train score for ls model is {}".format(train_score_ls))
print("The test score for ls model is {}".format(test_score_ls))

```

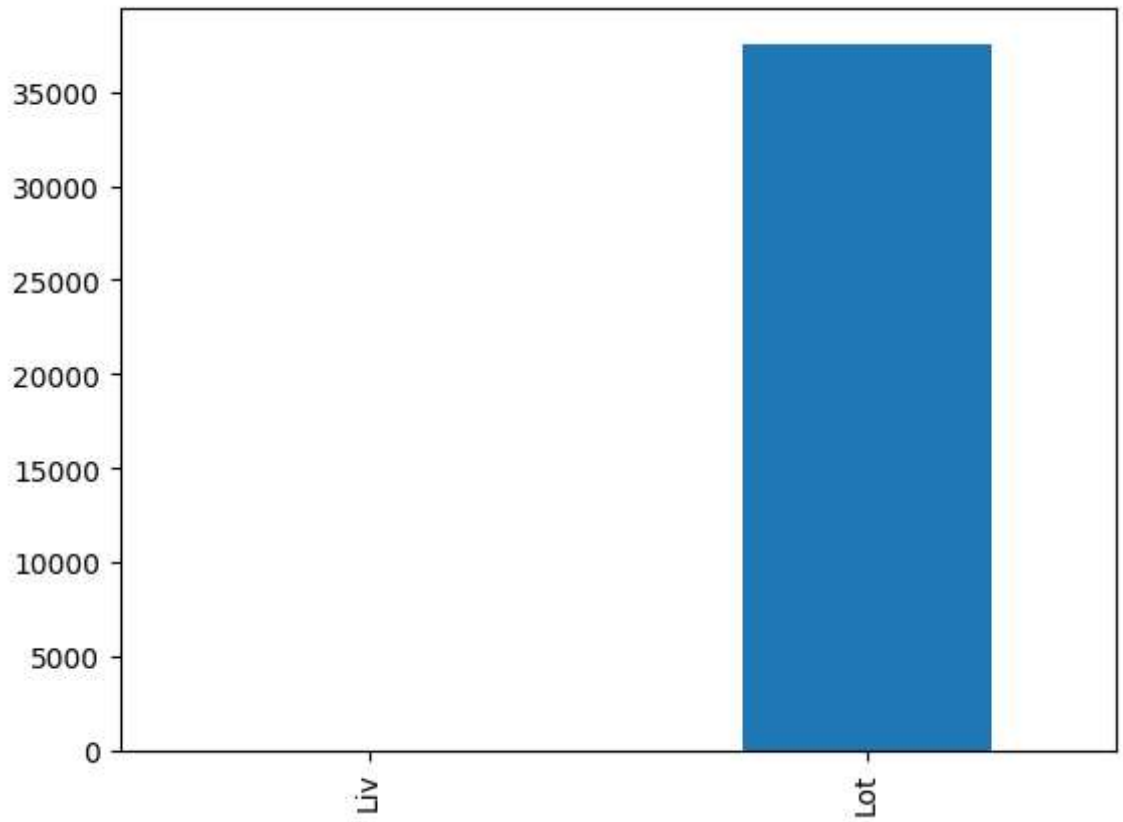
```
Lasso Model:

The train score for ls model is 0.9999999291360324
The test score for ls model is 0.9999999291231869
```

In [24]:

```
pd.Series(lasso.coef_, features).sort_values(ascending = True).plot(kind = "bar")
```

Out[24]:

```
<Axes: >
```



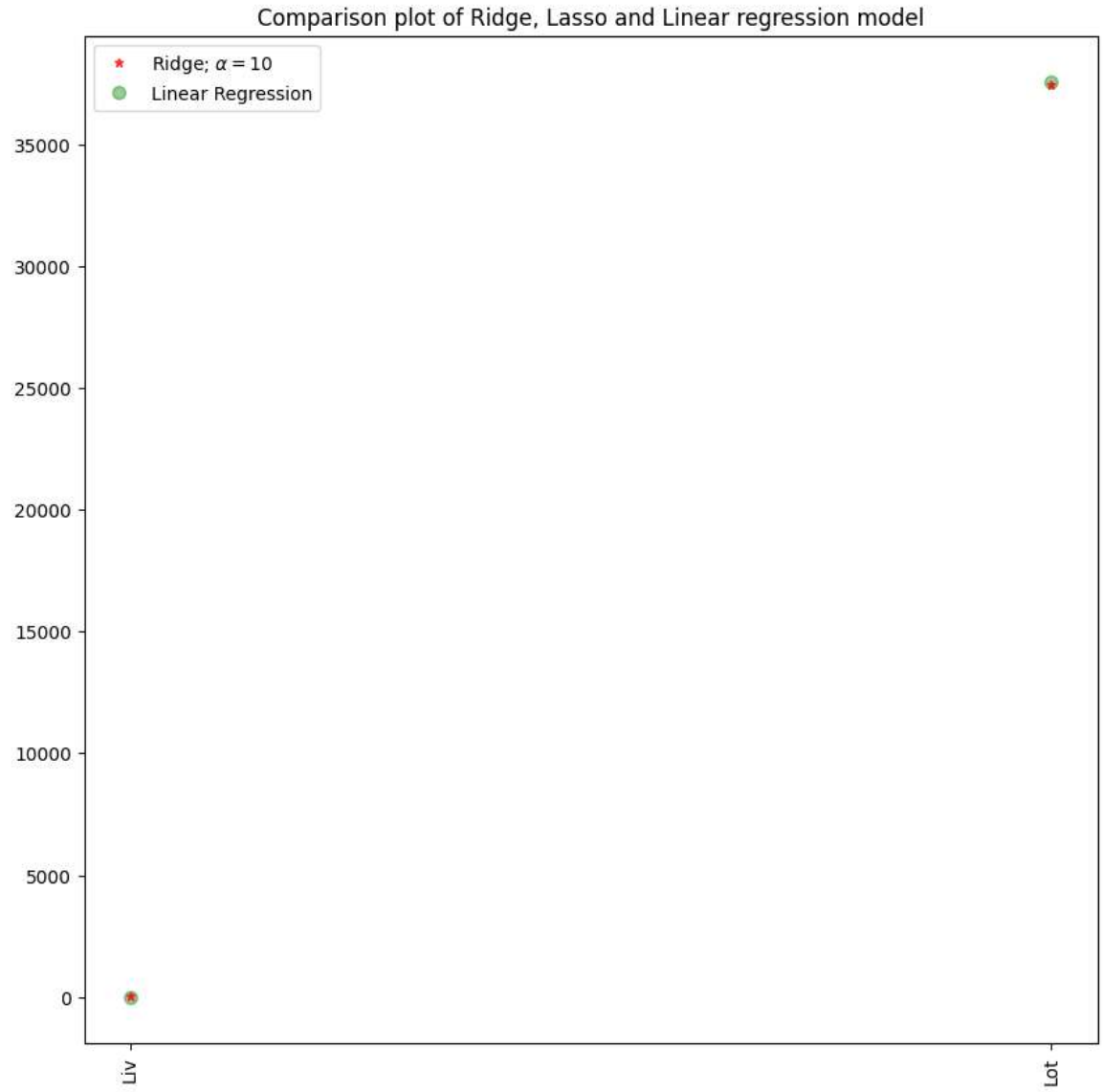
In [25]:

```
#Using the linear CV model
from sklearn.linear_model import LassoCV
#Lasso Cross validation
lasso_cv = LassoCV(alphas = [0.0001, 0.001,0.01, 0.1, 1, 10], random_state=0).fit(X_t
#score
print(lasso_cv.score(X_train, y_train))
print(lasso_cv.score(X_test, y_test))

```

```
0.9999999999997705
0.9999999999996928
```

In [26]:

```
#plot size
plt.figure(figsize = (10, 10))
#add plot for ridge regression
plt.plot(features,ridgeReg.coef_,alpha=0.7,linestyle='none',marker='*',markersize=5,c
#add plot for lasso regression
#plt.plot(lasso_cv.coef_,alpha=0.5,linestyle='none',marker='d',markersize=6,color='bl
#add plot for linear model
plt.plot(features,lr.coef_,alpha=0.4,linestyle='none',marker='o',markersize=7,color='
#rotate axis
plt.xticks(rotation = 90)
plt.legend()
plt.title("Comparison plot of Ridge, Lasso and Linear regression model")
plt.show()

```



In [27]:

```
#Using the linear CV model
from sklearn.linear_model import RidgeCV
#Ridge Cross validation
ridge_cv = RidgeCV(alphas = [0.0001, 0.001,0.01, 0.1, 1, 10]).fit(X_train, y_train)
#score
print("The train score for ridge model is {}".format(ridge_cv.score(X_train, y_train)))
print("The train score for ridge model is {}".format(ridge_cv.score(X_test, y_test)))
```

```
The train score for ridge model is 0.9999999999999996
The train score for ridge model is 0.9999999999999994
```

In [28]:

```
from sklearn.linear_model import ElasticNet
regr=ElasticNet()
regr.fit(X,y)
print(regr.coef_)
print(regr.intercept_)
```

```
[7.84570096e-07 9.99999995e-01]
-0.0016010777617339045
```

In [29]:

```
y_pred_elastic=regr.predict(X_train)

```

In [30]:

```
mean_squared_error=np.mean((y_pred_elastic-y_train)**2)
print("Mean Squared Error on test set",mean_squared_error)
```

```
Mean Squared Error on test set 1635484254.2408667
```

In [ ]:

```

```