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\91903\Downloads\fiat500_VehicleSelection_Dataset.csv
dt
```

Out[2]:

	ID	model	engine_power	age_in_days	km	previous_owners	lat	lon
0	1	lounge	51	882	25000	1	44.907242	8.611560
1	2	pop	51	1186	32500	1	45.666359	12.241890
2	3	sport	74	4658	142228	1	45.503300	11.417840
3	4	lounge	51	2739	160000	1	40.633171	17.634609
4	5	pop	73	3074	106880	1	41.903221	12.495650
...	...	...	...	...	...	...	...	...
1533	1534	sport	51	3712	115280	1	45.069679	7.704920
1534	1535	lounge	74	3835	112000	1	45.845692	8.666870
1535	1536	pop	51	2223	60457	1	45.481541	9.413480
1536	1537	lounge	51	2557	80750	1	45.000702	7.682270
1537	1538	pop	51	1766	54276	1	40.323410	17.568270

1538 rows × 9 columns

In [3]:
```
dt=dt[['engine_power','price']]
dt.columns=['Engine','Pric']
```

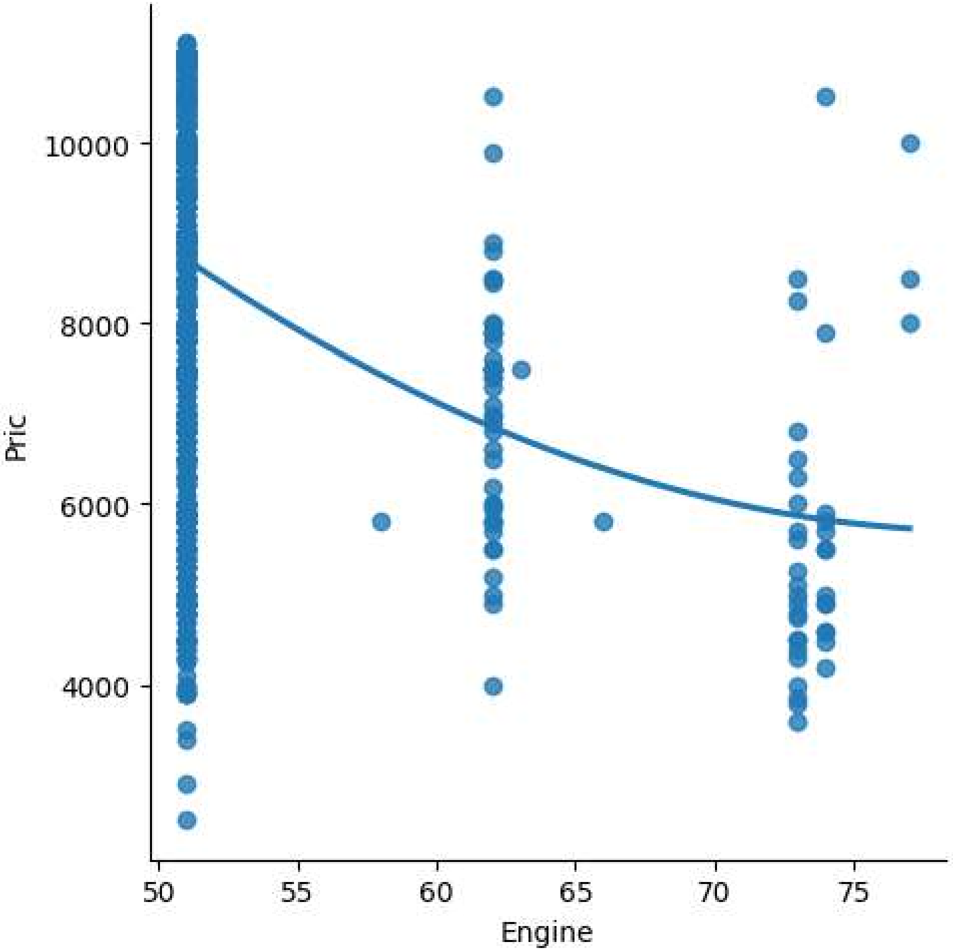
In [4]:
```
dt.head(10)
```

Out[4]:

	Engine	Pric
0	51	8900
1	51	8800
2	74	4200
3	51	6000
4	73	5700
5	74	7900
6	51	10750
7	51	9190
8	73	5600
9	51	6000

In [5]:
```
sns.lmplot(x='Engine',y='Pric',data=dt,order=2,ci=None)
```

Out[5]:
```
<seaborn.axisgrid.FacetGrid at 0x2f647c4cfd0>
```



In [6]:
```
dt.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1538 entries, 0 to 1537
Data columns (total 2 columns):
 #   Column  Non-Null Count  Dtype
---  ------  --------------  -----
 0   Engine  1538 non-null   int64
 1   Pric    1538 non-null   int64
dtypes: int64(2)
memory usage: 24.2 KB
```

In [7]:
```
dt.describe()
```

Out[7]:

	Engine	Pric
count	1538.000000	1538.000000
mean	51.904421	8576.003901
std	3.988023	1939.958641
min	51.000000	2500.000000
25%	51.000000	7122.500000
50%	51.000000	9000.000000
75%	51.000000	10000.000000
max	77.000000	11100.000000

In [8]:
```
dt.fillna(method='ffill')
```

Out[8]:

	Engine	Pric
0	51	8900
1	51	8800
2	74	4200
3	51	6000
4	73	5700
...	...	...
1533	51	5200
1534	74	4600
1535	51	7500
1536	51	5990
1537	51	7900

1538 rows × 2 columns

In [9]:

```
x=np.array(dt['Engine']).reshape(-1,1)
y=np.array(dt['Pric']).reshape(-1,1)
```

In [10]:

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

```
C:\Users\91903\AppData\Local\Temp\ipykernel_5464\735218168.py:1: SettingWithC
opyWarning:
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/s
table/user_guide/indexing.html#returning-a-view-versus-a-copy (https://panda
s.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-ver
sus-a-copy)
  dt.dropna(inplace=True)
```

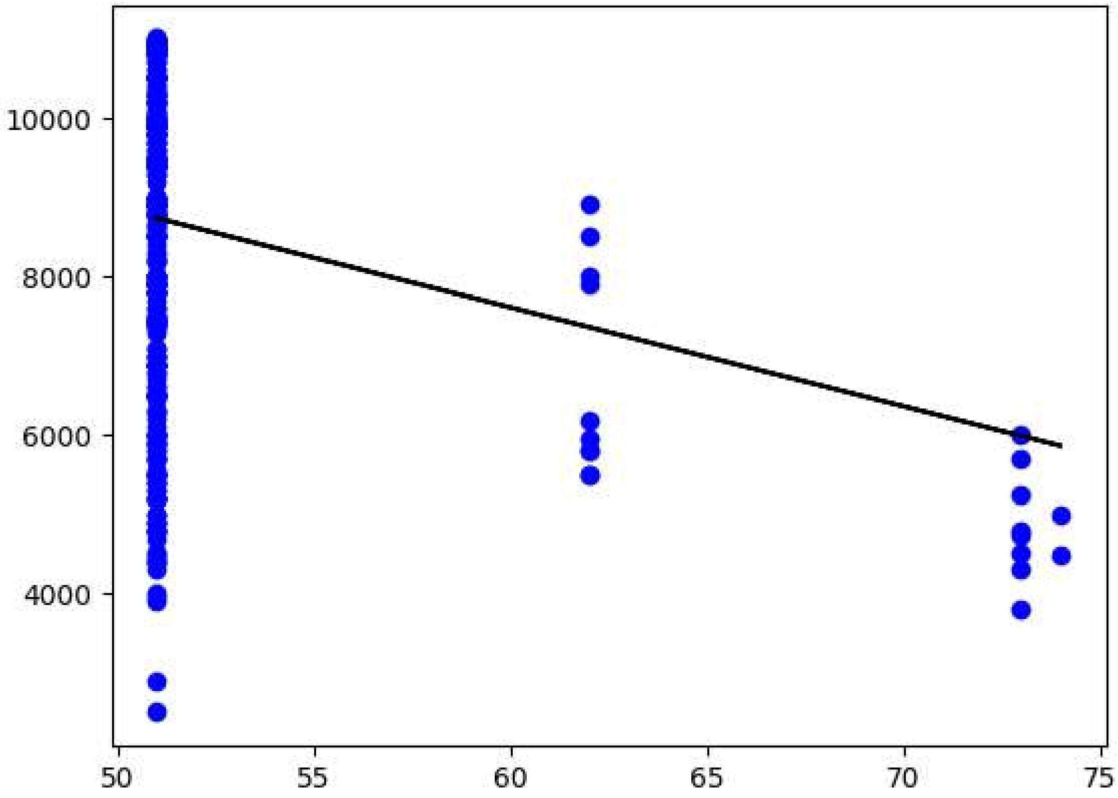
In [11]:

```
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))
```

```
0.09048902894808675
```

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()
```

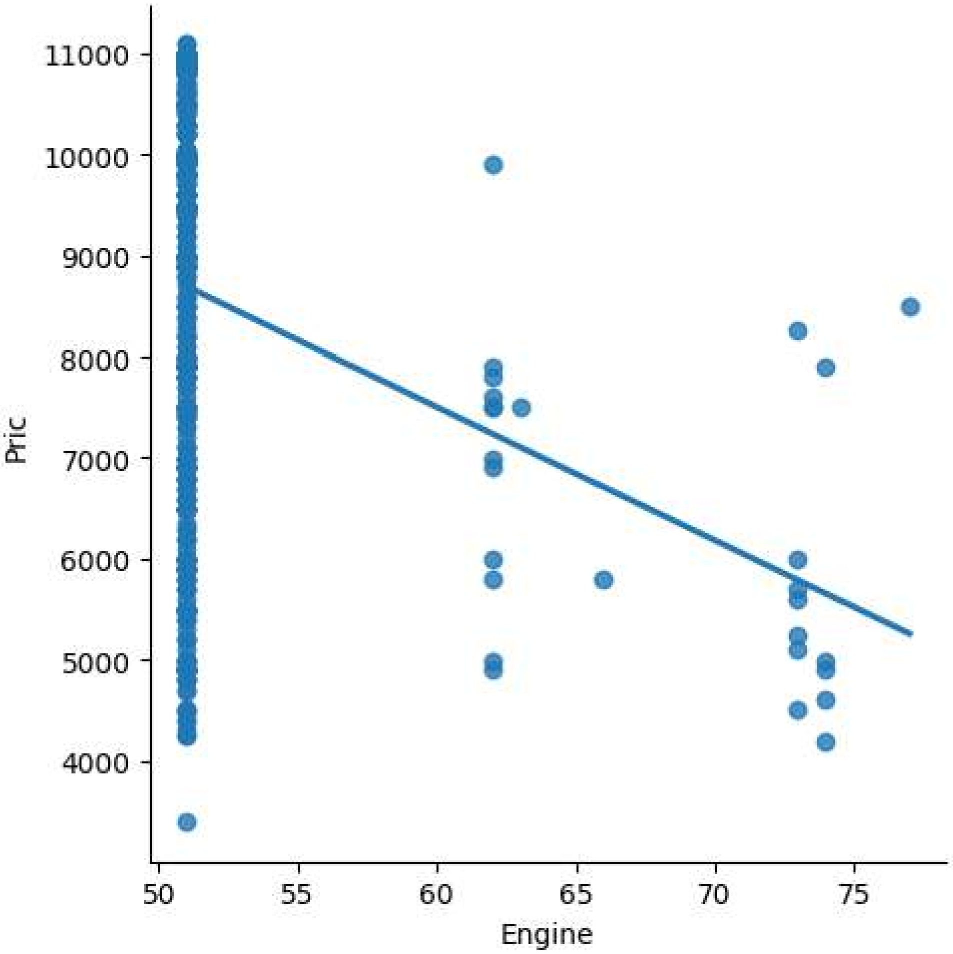


In [13]:

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

Out[13]:

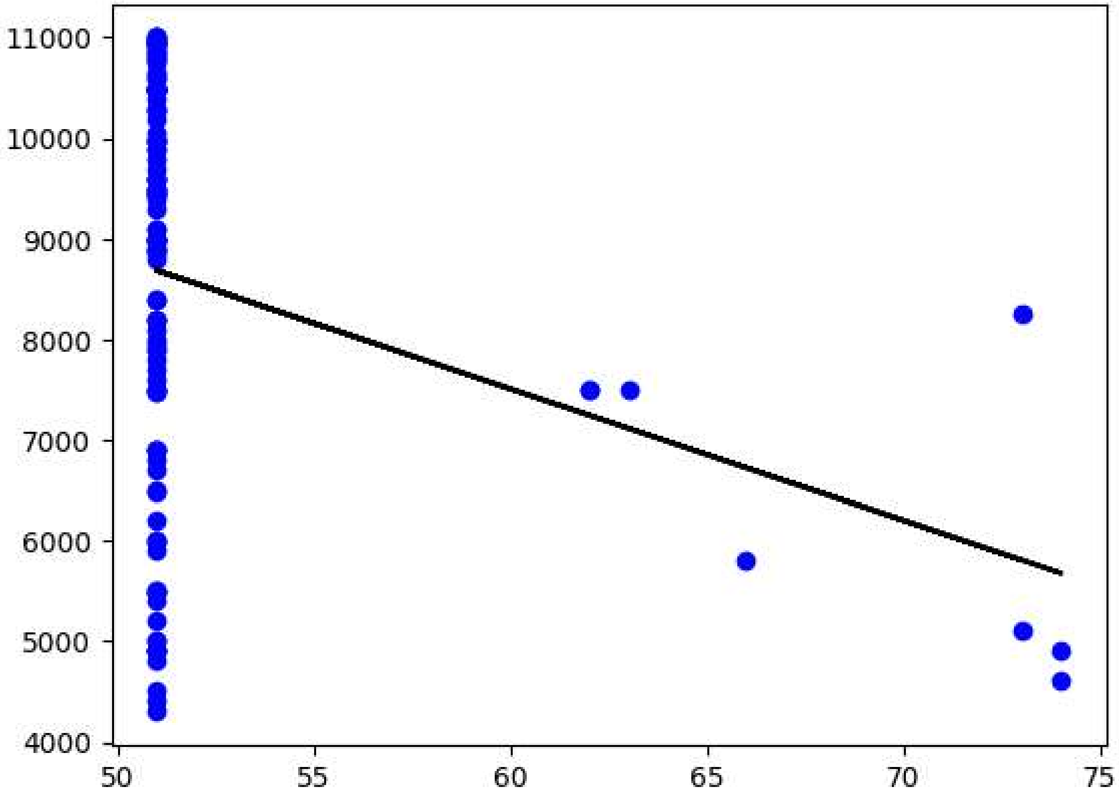
```
<seaborn.axisgrid.FacetGrid at 0x2f6359d0550>
```



In [14]:

```
dt500.fillna(method='ffill',inplace=True)
X=np.array(dt500['Engine']).reshape(-1,1)
y=np.array(dt500['Pric']).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: 0.08585204069415087
```



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: 0.08585204069415087
```

#conclusion : Linear regression is not fit for the model

Ridge and Lasso Regression

In [16]:

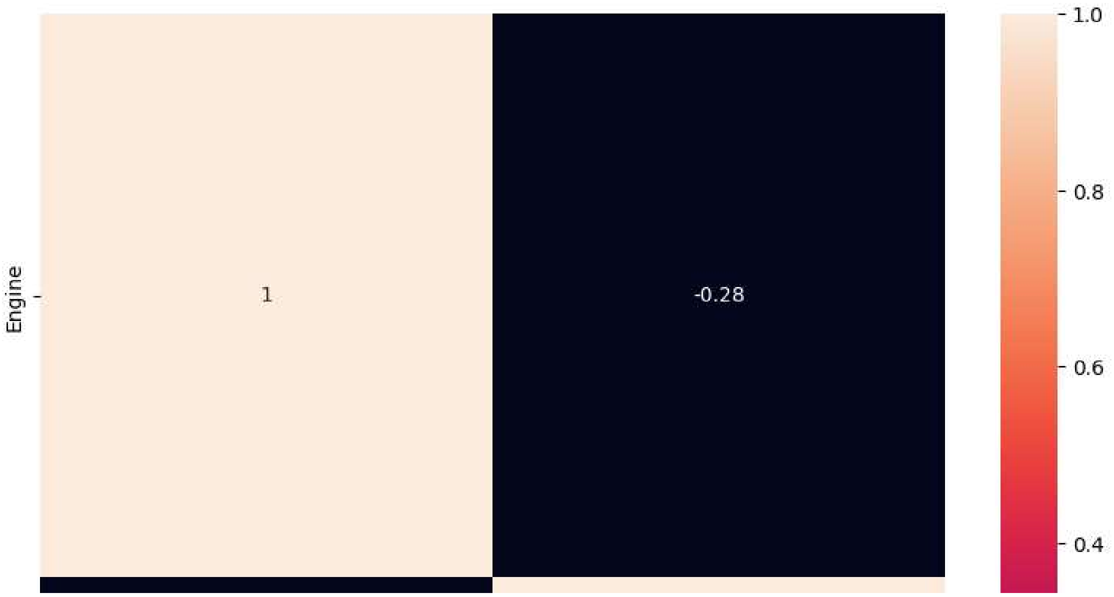
```
from sklearn.preprocessing import StandardScaler
from sklearn.linear_model import Ridge
from sklearn.linear_model import RidgeCV
from sklearn.linear_model import Lasso
```

In [17]:

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

Out[17]:

```
<Axes: >
```



In [19]:

```
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, rando
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 (1076, 2)
The dimension of X_test is (462, 2)
```

In [20]:

```
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))
```

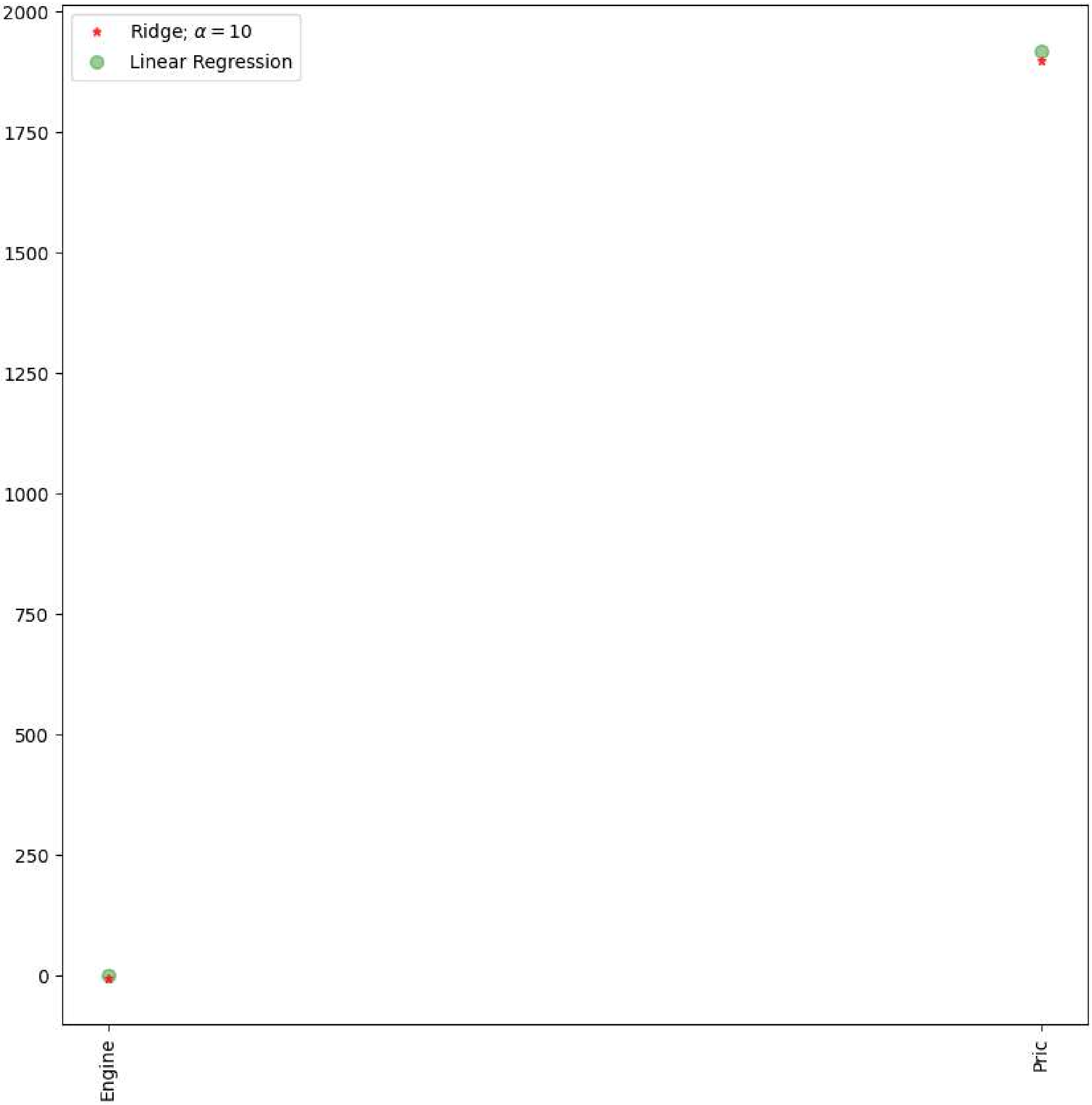
```

Linear Regression Model:

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

In [21]:

```
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 0.9999088581979684
The test score for ridge model is 0.9999100853681023
```

In [22]:
```
plt.figure(figsize = (10, 10))
plt.plot(features,ridgeReg.coef_,alpha=0.7,linestyle='none',marker='*',markers

plt.plot(features,lr.coef_,alpha=0.4,linestyle='none',marker='o',markersize=7,
plt.xticks(rotation = 90)
plt.legend()
plt.show()
```



In [23]:

```
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 train score for ls model is {}".format(test_score_ls))
```

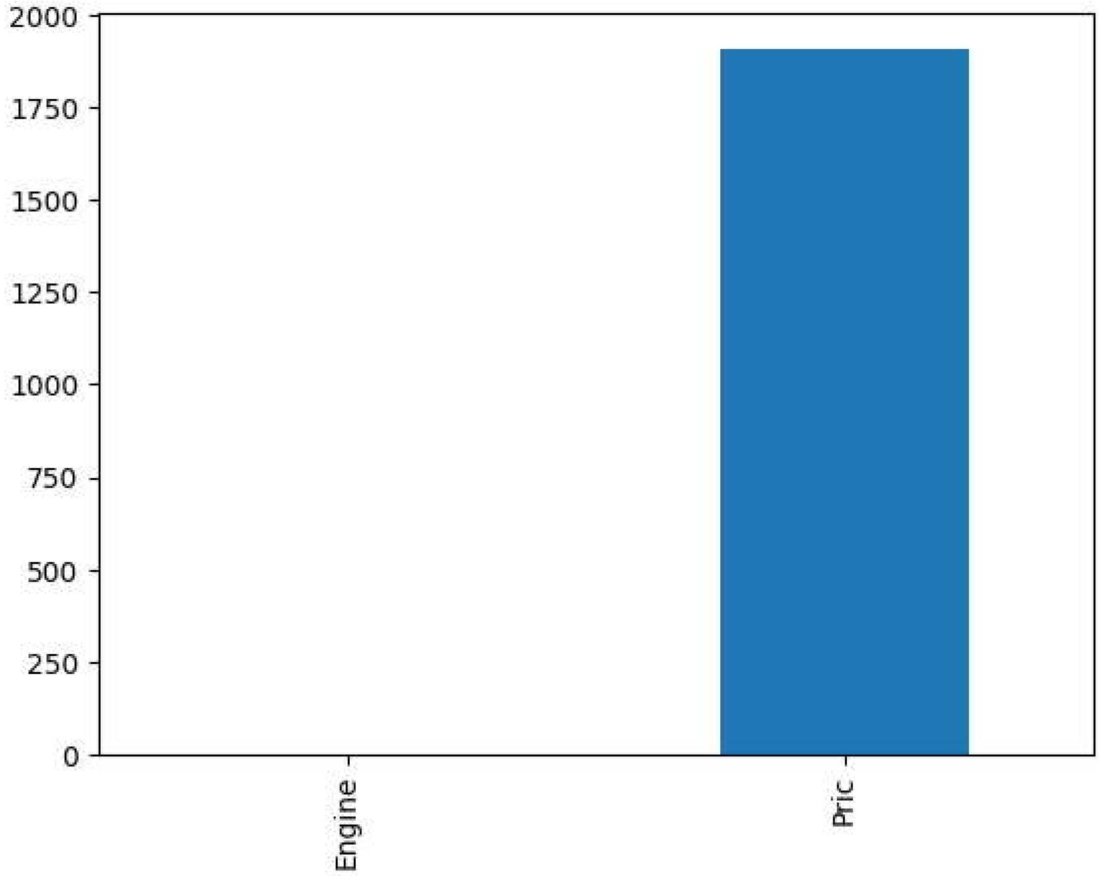
```

Lasso Model: 

The train score for ls model is 0.9999728562194999
The train score for ls model is 0.9999728508562553
```

In [24]:

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

Out[24]:

```
<Axes: >
```

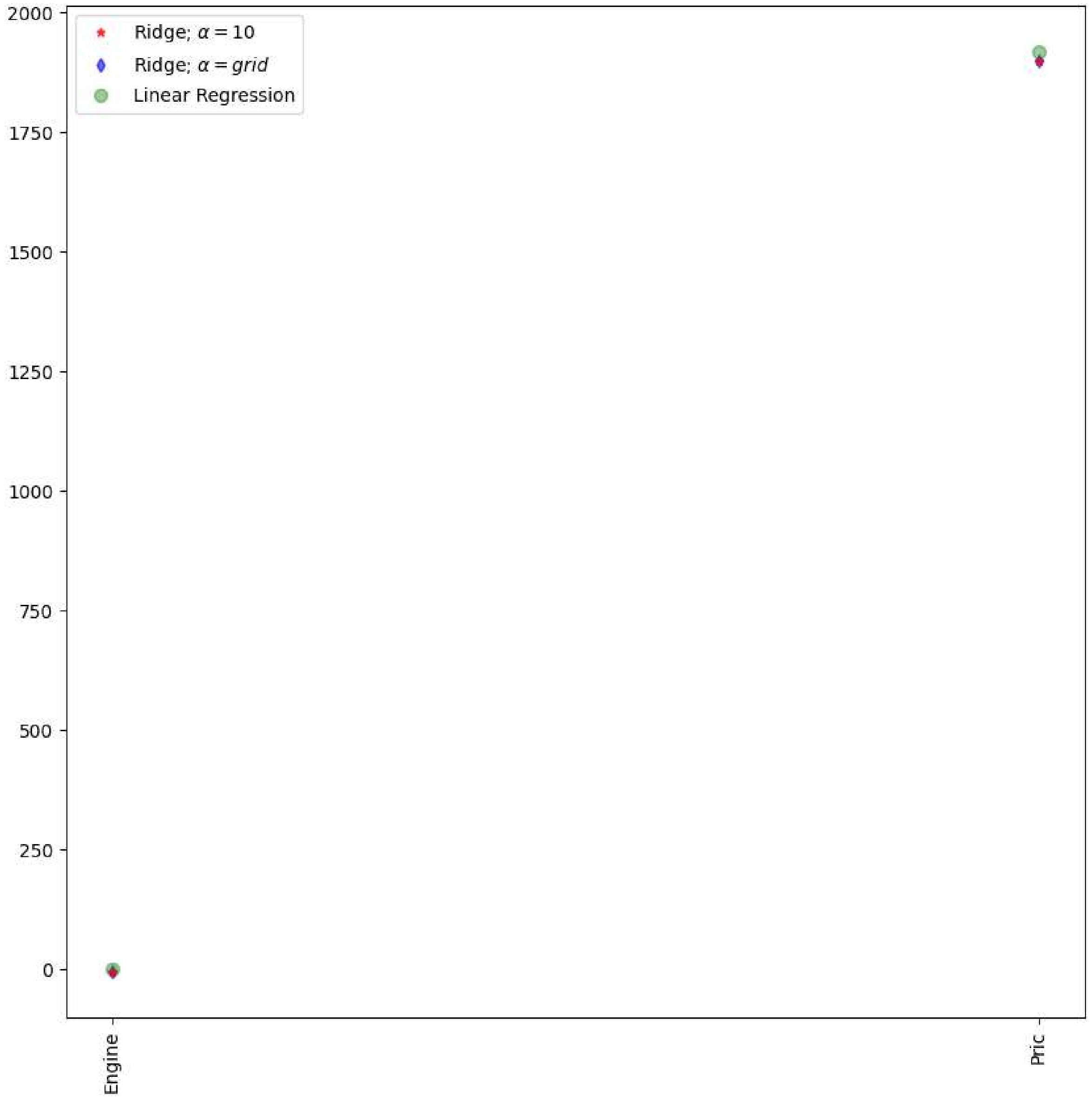


In [25]:

```
#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).
#score
print(lasso_cv.score(X_train, y_train))
print(lasso_cv.score(X_test, y_test))
```

```
0.9999999999501757
0.9999999999638806
```

In [26]:
```
plt.figure(figsize = (10, 10))
plt.plot(features,ridgeReg.coef_,alpha=0.7,linestyle='none',marker='*',markers
plt.plot(features,ridgeReg.coef_,alpha=0.6,linestyle='none',marker='d',markers

plt.plot(features,lr.coef_,alpha=0.4,linestyle='none',marker='o',markersize=7,
plt.xticks(rotation = 90)
plt.legend()
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_t
         #score
         print("The train score for ridge model is {}".format(ridge_cv.score(X_train, y
         print("The train score for ridge model is {}".format(ridge_cv.score(X_test, y_
```

```
The train score for ridge model is 0.9999999999999898
The train score for ridge model is 0.99999999999999
```

ElasticNet Regression

```
In [28]: from sklearn.linear_model import ElasticNet
         regr=ElasticNet()
         regr.fit(X,y)
         print(regr.coef_)
         print(regr.intercept_)
```

```
[-0.          0.99999973]
0.002280249860632466
```

```
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 77371869.93693778
```

```
In [ ]:
```