In [2]:

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.model_selection import train_test_split
from sklearn.tree import DecisionTreeRegressor

data = pd.read_csv("dataset.csv")
data.head()
```

Out [2]:

	car_ID	symboling	CarName	fueltype	aspiration	doornumber	carbody	drivewheel	enginelocation	wheelbase	...	enginesize
0	1	3	alfa-romero giulia	gas	std	two	convertible	rwd	front	88.6	...	130
1	2	3	alfa-romero stelvio	gas	std	two	convertible	rwd	front	88.6	...	130
2	3	1	alfa-romero Quadrifoglio	gas	std	two	hatchback	rwd	front	94.5	...	152
3	4	2	audi 100 ls	gas	std	four	sedan	fwd	front	99.8	...	109
4	5	2	audi 100ls	gas	std	four	sedan	4wd	front	99.4	...	136

5 rows × 26 columns

In [3]:

```
data.isnull().sum()
```

Out [3]:

```
car_ID              0
symboling           0
CarName             0
fueltype            0
aspiration          0
doornumber          0
carbody             0
drivewheel          0
enginelocation      0
wheelbase           0
carlength           0
carwidth            0
carheight           0
curbweight          0
enginetype          0
cylindernumber      0
enginesize          0
fuelsystem          0
boreratio           0
stroke              0
compressionratio    0
horsepower          0
peakrpm             0
citympg             0
highwaympg          0
price               0
dtype: int64
```

In [4]:

```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 205 entries, 0 to 204
Data columns (total 26 columns):
 #   Column            Non-Null Count  Dtype  
---  ------            --------------  -----  
 0   car_ID            205 non-null    int64  
 1   symboling         205 non-null    int64  
 2   CarName           205 non-null    object 
 3   fueltype          205 non-null    object 
 4   aspiration        205 non-null    object 
 5   doornumber        205 non-null    object 
 6   carbody           205 non-null    object 
 7   drivewheel        205 non-null    object 
 8   enginelocation    205 non-null    object 
 9   wheelbase         205 non-null    float64
 10  carlength         205 non-null    float64
 11  carwidth          205 non-null    float64
 12  carheight         205 non-null    float64
 13  curbweight        205 non-null    int64  
 14  enginetype        205 non-null    object 
 15  cylindernumber    205 non-null    object 
 16  enginesize        205 non-null    int64  
 17  fuelsystem        205 non-null    object 
 18  boreratio         205 non-null    float64
 19  stroke            205 non-null    float64
 20  compressionratio  205 non-null    float64
 21  horsepower        205 non-null    int64  
 22  peakrpm           205 non-null    int64  
 23  citympg           205 non-null    int64  
 24  highwaympg        205 non-null    int64  
 25  price             205 non-null    float64
dtypes: float64(8), int64(8), object(10)
memory usage: 41.8+ KB
```

In [5]:

```
print(data.describe())
```

```
           car_ID   symboling   wheelbase   carlength    carwidth   carheight  \
count  205.000000  205.000000  205.000000  205.000000  205.000000  205.000000
mean   103.000000    0.834146   98.756585  174.049268   65.907805   53.724878
std     59.322565    1.245307    6.021776   12.337289    2.145204    2.443522
min      1.000000   -2.000000   86.600000  141.100000   60.300000   47.800000
25%     52.000000    0.000000   94.500000  166.300000   64.100000   52.000000
50%    103.000000    1.000000   97.000000  173.200000   65.500000   54.100000
75%    154.000000    2.000000  102.400000  183.100000   66.900000   55.500000
max    205.000000    3.000000  120.900000  208.100000   72.300000   59.800000

        curbweight  enginesize   boreratio      stroke  compressionratio  \
count   205.000000  205.000000  205.000000  205.000000        205.000000
mean   2555.565854  126.907317    3.329756    3.255415         10.142537
std     520.680204   41.642693    0.270844    0.313597          3.972040
min    1488.000000   61.000000    2.540000    2.070000          7.000000
25%    2145.000000   97.000000    3.150000    3.110000          8.600000
50%    2414.000000  120.000000    3.310000    3.290000          9.000000
75%    2935.000000  141.000000    3.580000    3.410000          9.400000
max    4066.000000  326.000000    3.940000    4.170000         23.000000

       horsepower      peakrpm     citympg  highwaympg         price
count  205.000000   205.000000  205.000000  205.000000    205.000000
mean   104.117073  5125.121951   25.219512   30.751220  13276.710571
std     39.544167   476.985643    6.542142    6.886443   7988.852332
min     48.000000  4150.000000   13.000000   16.000000   5118.000000
25%     70.000000  4800.000000   19.000000   25.000000   7788.000000
50%     95.000000  5200.000000   24.000000   30.000000  10295.000000
75%    116.000000  5500.000000   30.000000   34.000000  16503.000000
max    288.000000  6600.000000   49.000000   54.000000  45400.000000
```

In [6]:
```
data.CarName.unique()
```

Out [6]:
```
array(['alfa-romero giulia', 'alfa-romero stelvio',
       'alfa-romero Quadrifoglio', 'audi 100 ls', 'audi 100ls',
       'audi fox', 'audi 5000', 'audi 4000', 'audi 5000s (diesel)',
       'bmw 320i', 'bmw x1', 'bmw x3', 'bmw z4', 'bmw x4', 'bmw x5',
       'chevrolet impala', 'chevrolet monte carlo', 'chevrolet vega 2300',
       'dodge rampage', 'dodge challenger se', 'dodge d200',
       'dodge monaco (sw)', 'dodge colt hardtop', 'dodge colt (sw)',
       'dodge coronet custom', 'dodge dart custom',
       'dodge coronet custom (sw)', 'honda civic', 'honda civic cvcc',
       'honda accord cvcc', 'honda accord lx', 'honda civic 1500 gl',
       'honda accord', 'honda civic 1300', 'honda prelude',
       'honda civic (auto)', 'isuzu MU-X', 'isuzu D-Max ',
       'isuzu D-Max V-Cross', 'jaguar xj', 'jaguar xf', 'jaguar xk',
       'maxda rx3', 'maxda glc deluxe', 'mazda rx2 coupe', 'mazda rx-4',
       'mazda glc deluxe', 'mazda 626', 'mazda glc', 'mazda rx-7 gs',
       'mazda glc 4', 'mazda glc custom l', 'mazda glc custom',
       'buick electra 225 custom', 'buick century luxus (sw)',
       'buick century', 'buick skyhawk', 'buick opel isuzu deluxe',
       'buick skylark', 'buick century special',
       'buick regal sport coupe (turbo)', 'mercury cougar',
       'mitsubishi mirage', 'mitsubishi lancer', 'mitsubishi outlander',
       'mitsubishi g4', 'mitsubishi mirage g4', 'mitsubishi montero',
       'mitsubishi pajero', 'Nissan versa', 'nissan gt-r', 'nissan rogue',
       'nissan latio', 'nissan titan', 'nissan leaf', 'nissan juke',
       'nissan note', 'nissan clipper', 'nissan nv200', 'nissan dayz',
       'nissan fuga', 'nissan otti', 'nissan teana', 'nissan kicks',
       'peugeot 504', 'peugeot 304', 'peugeot 504 (sw)', 'peugeot 604sl',
       'peugeot 505s turbo diesel', 'plymouth fury iii',
       'plymouth cricket', 'plymouth satellite custom (sw)',
       'plymouth fury gran sedan', 'plymouth valiant', 'plymouth duster',
       'porsche macan', 'porcshce panamera', 'porsche cayenne',
       'porsche boxter', 'renault 12tl', 'renault 5 gtl', 'saab 99e',
       'saab 99le', 'saab 99gle', 'subaru', 'subaru dl', 'subaru brz',
       'subaru baja', 'subaru r1', 'subaru r2', 'subaru trezia',
       'subaru tribeca', 'toyota corona mark ii', 'toyota corona',
       'toyota corolla 1200', 'toyota corona hardtop',
       'toyota corolla 1600 (sw)', 'toyota carina', 'toyota mark ii',
       'toyota corolla', 'toyota corolla liftback',
       'toyota celica gt liftback', 'toyota corolla tercel',
       'toyota corona liftback', 'toyota starlet', 'toyota tercel',
       'toyota cressida', 'toyota celica gt', 'toyouta tercel',
       'vokswagen rabbit', 'volkswagen 1131 deluxe sedan',
       'volkswagen model 111', 'volkswagen type 3', 'volkswagen 411 (sw)',
       'volkswagen super beetle', 'volkswagen dasher', 'vw dasher',
       'vw rabbit', 'volkswagen rabbit', 'volkswagen rabbit custom',
       'volvo 145e (sw)', 'volvo 144ea', 'volvo 244dl', 'volvo 245',
       'volvo 264gl', 'volvo diesel', 'volvo 246'], dtype=object)
```

In [7]:
```
sns.set_style("whitegrid")
plt.figure(figsize=(15, 10))
sns.distplot(data.price)
plt.show()
```

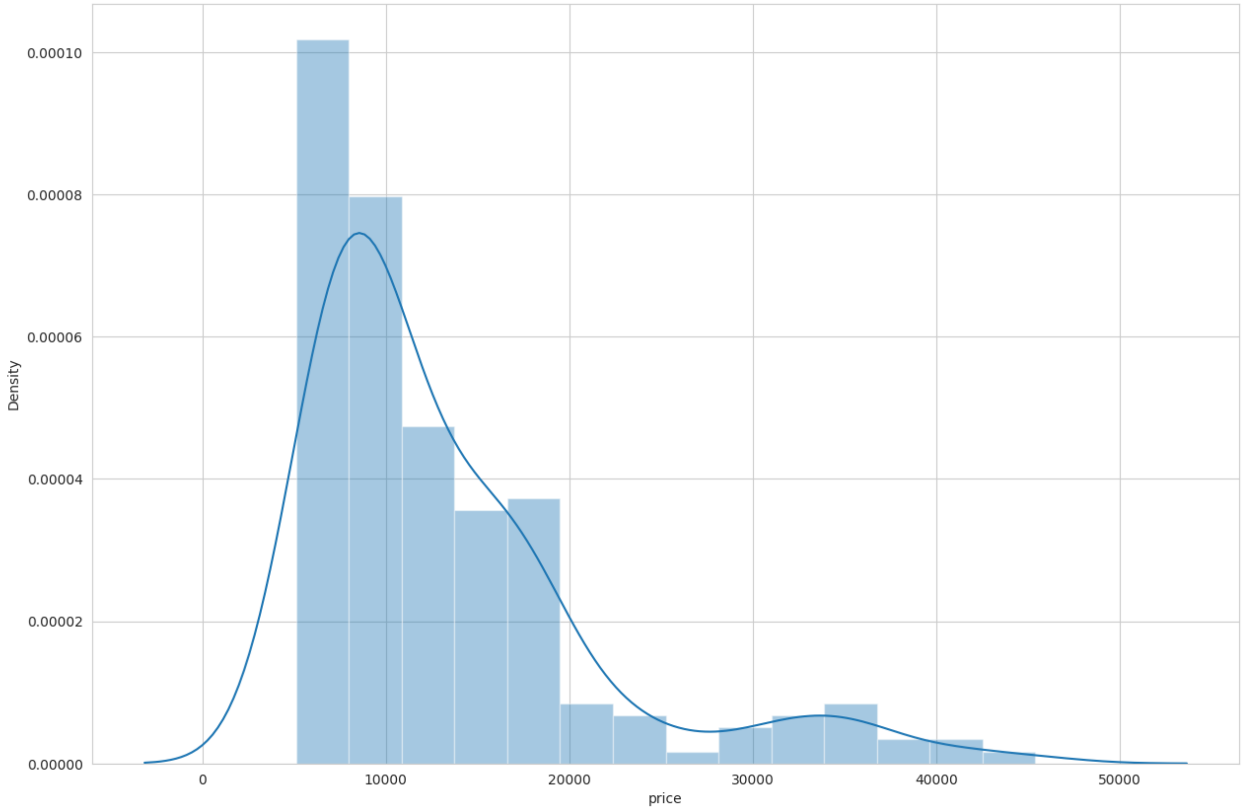
```
<ipython-input-7-304581fcc834>:3: UserWarning:

`distplot` is a deprecated function and will be removed in seaborn v0.14.0.

Please adapt your code to use either `displot` (a figure-level function with
similar flexibility) or `histplot` (an axes-level function for histograms).

For a guide to updating your code to use the new functions, please see
https://gist.github.com/mwaskom/de44147ed2974457ad6372750bbe5751

  sns.distplot(data.price)
```



In [8]:

```
print(data.corr())
```

```
                     car_ID  symboling  wheelbase  carlength   carwidth  \
car_ID             1.000000  -0.151621   0.129729   0.170636   0.052387   
symboling         -0.151621   1.000000  -0.531954  -0.357612  -0.232919   
wheelbase          0.129729  -0.531954   1.000000   0.874587   0.795144   
carlength          0.170636  -0.357612   0.874587   1.000000   0.841118   
carwidth           0.052387  -0.232919   0.795144   0.841118   1.000000   
carheight          0.255960  -0.541038   0.589435   0.491029   0.279210   
curbweight         0.071962  -0.227691   0.776386   0.877728   0.867032   
enginesize        -0.033930  -0.105790   0.569329   0.683360   0.735433   
boreratio          0.260064  -0.130051   0.488750   0.606454   0.559150   
stroke            -0.160824  -0.008735   0.160959   0.129533   0.182942   
compressionratio   0.150276  -0.178515   0.249786   0.158414   0.181129   
horsepower        -0.015006   0.070873   0.353294   0.552623   0.640732   
peakrpm           -0.203789   0.273606  -0.360469  -0.287242  -0.220012   
citympg            0.015940  -0.035823  -0.470414  -0.670909  -0.642704   
highwaympg         0.011255   0.034606  -0.544082  -0.704662  -0.677218   
price             -0.109093  -0.079978   0.577816   0.682920   0.759325   

                  carheight  curbweight  enginesize  boreratio     stroke  \
car_ID             0.255960    0.071962   -0.033930   0.260064  -0.160824   
symboling         -0.541038   -0.227691   -0.105790  -0.130051  -0.008735   
wheelbase          0.589435    0.776386    0.569329   0.488750   0.160959   
carlength          0.491029    0.877728    0.683360   0.606454   0.129533   
carwidth           0.279210    0.867032    0.735433   0.559150   0.182942   
carheight          1.000000    0.295572    0.067149   0.171071  -0.055307   
curbweight         0.295572    1.000000    0.850594   0.648480   0.168790   
enginesize         0.067149    0.850594    1.000000   0.583774   0.203129   
boreratio          0.171071    0.648480    0.583774   1.000000  -0.055909   
stroke            -0.055307    0.168790    0.203129  -0.055909   1.000000   
compressionratio   0.261214    0.151362    0.028971   0.005197   0.186110   
horsepower        -0.108802    0.750739    0.809769   0.573677   0.080940   
peakrpm           -0.320411   -0.266243   -0.244660  -0.254976  -0.067964   
citympg           -0.048640   -0.757414   -0.653658  -0.584532  -0.042145   
highwaympg        -0.107358   -0.797465   -0.677470  -0.587012  -0.043931   
price              0.119336    0.835305    0.874145   0.553173   0.079443   

                  compressionratio  horsepower    peakrpm    citympg  \
car_ID                    0.150276   -0.015006  -0.203789   0.015940   
symboling                -0.178515    0.070873   0.273606  -0.035823   
wheelbase                 0.249786    0.353294  -0.360469  -0.470414   
carlength                 0.158414    0.552623  -0.287242  -0.670909   
carwidth                  0.181129    0.640732  -0.220012  -0.642704   
carheight                 0.261214   -0.108802  -0.320411  -0.048640   
curbweight                0.151362    0.750739  -0.266243  -0.757414   
enginesize                0.028971    0.809769  -0.244660  -0.653658   
boreratio                 0.005197    0.573677  -0.254976  -0.584532   
stroke                    0.186110    0.080940  -0.067964  -0.042145   
compressionratio          1.000000   -0.204326  -0.435741   0.324701   
horsepower               -0.204326    1.000000   0.131073  -0.801456   
peakrpm                  -0.435741    0.131073   1.000000  -0.113544   
citympg                   0.324701   -0.801456  -0.113544   1.000000   
highwaympg                0.265201   -0.770544  -0.054275   0.971337   
price                     0.067984    0.808139  -0.085267  -0.685751   

                  highwaympg      price  
car_ID              0.011255  -0.109093  
symboling           0.034606  -0.079978  
wheelbase          -0.544082   0.577816  
carlength          -0.704662   0.682920  
carwidth           -0.677218   0.759325  
carheight          -0.107358   0.119336  
curbweight         -0.797465   0.835305  
enginesize         -0.677470   0.874145  
```

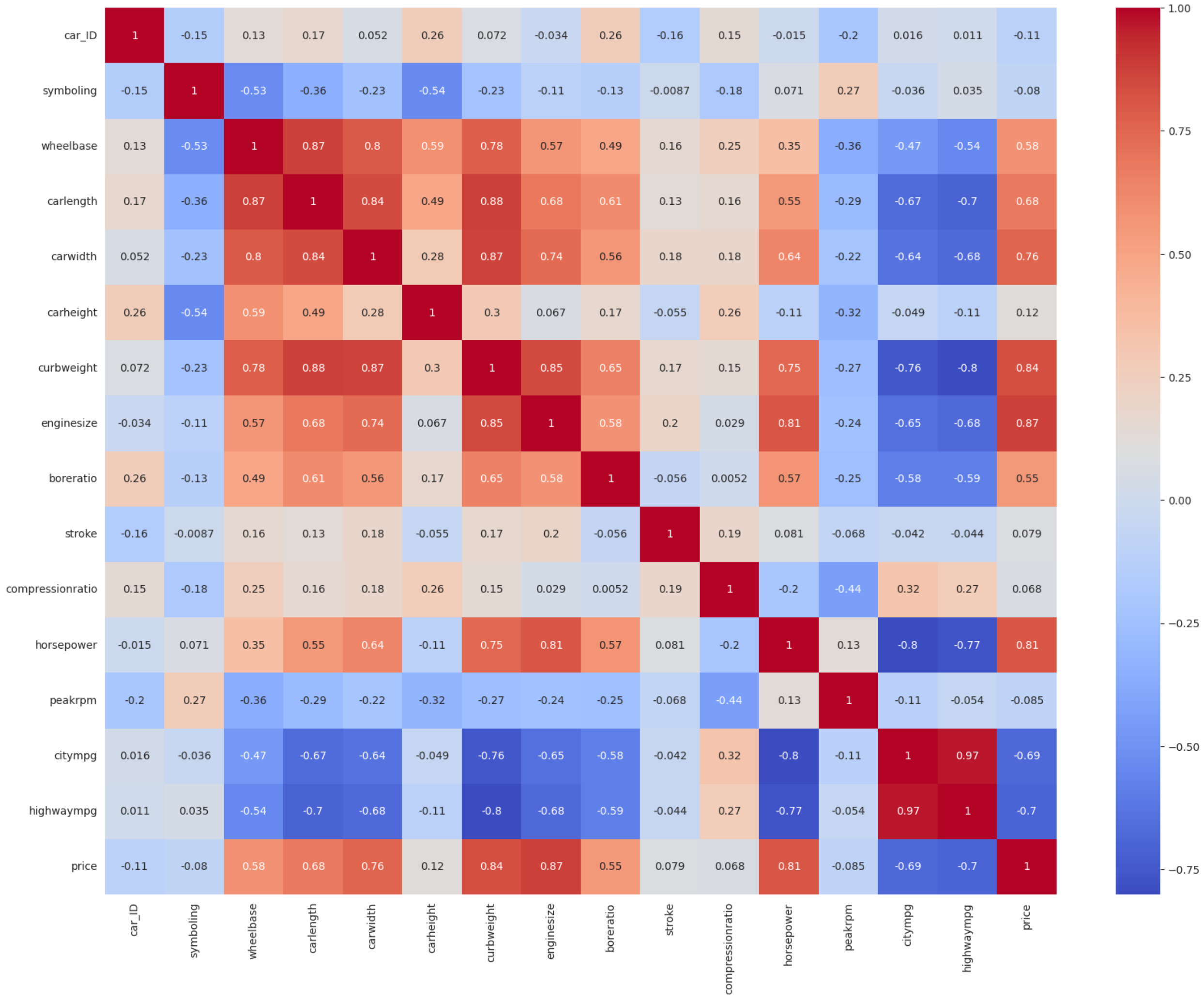
```
boreratio          -0.587012  0.553173
stroke             -0.043931  0.079443
compressionratio    0.265201  0.067984
horsepower         -0.770544  0.808139
peakrpm            -0.054275 -0.085267
citympg             0.971337 -0.685751
highwaympg          1.000000 -0.697599
price              -0.697599  1.000000
```

```
<ipython-input-8-40835d1ef585>: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.
  print(data.corr())
```

In [9]:

```
plt.figure(figsize=(20, 15))
correlations = data.corr()
sns.heatmap(correlations, cmap="coolwarm", annot=True)
plt.show()
```

```
<ipython-input-9-555d4168b84a>:2: 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.
  correlations = data.corr()
```



	car_ID	symboling	wheelbase	carlength	carwidth	carheight	curbweight	enginesize	boreratio	stroke	compressionratio	horsepower	peakrpm	citympg	highwaympg	price
car_ID	1	-0.15	0.13	0.17	0.052	0.26	0.072	-0.034	0.26	-0.16	0.15	-0.015	-0.2	0.016	0.011	-0.11
symboling	-0.15	1	-0.53	-0.36	-0.23	-0.54	-0.23	-0.11	-0.13	-0.0087	-0.18	0.071	0.27	-0.036	0.035	-0.08
wheelbase	0.13	-0.53	1	0.87	0.8	0.59	0.78	0.57	0.49	0.16	0.25	0.35	-0.36	-0.47	-0.54	0.58
carlength	0.17	-0.36	0.87	1	0.84	0.49	0.88	0.68	0.61	0.13	0.16	0.55	-0.29	-0.67	-0.7	0.68
carwidth	0.052	-0.23	0.8	0.84	1	0.28	0.87	0.74	0.56	0.18	0.18	0.64	-0.22	-0.64	-0.68	0.76
carheight	0.26	-0.54	0.59	0.49	0.28	1	0.3	0.067	0.17	-0.055	0.26	-0.11	-0.32	-0.049	-0.11	0.12
curbweight	0.072	-0.23	0.78	0.88	0.87	0.3	1	0.85	0.65	0.17	0.15	0.75	-0.27	-0.76	-0.8	0.84
enginesize	-0.034	-0.11	0.57	0.68	0.74	0.067	0.85	1	0.58	0.2	0.029	0.81	-0.24	-0.65	-0.68	0.87
boreratio	0.26	-0.13	0.49	0.61	0.56	0.17	0.65	0.58	1	-0.056	0.0052	0.57	-0.25	-0.58	-0.59	0.55
stroke	-0.16	-0.0087	0.16	0.13	0.18	-0.055	0.17	0.2	-0.056	1	0.19	0.081	-0.068	-0.042	-0.044	0.079
compressionratio	0.15	-0.18	0.25	0.16	0.18	0.26	0.15	0.029	0.0052	0.19	1	-0.2	-0.44	0.32	0.27	0.068
horsepower	-0.015	0.071	0.35	0.55	0.64	-0.11	0.75	0.81	0.57	0.081	-0.2	1	0.13	-0.8	-0.77	0.81
peakrpm	-0.2	0.27	-0.36	-0.29	-0.22	-0.32	-0.27	-0.24	-0.25	-0.068	-0.44	0.13	1	-0.11	-0.054	-0.085
citympg	0.016	-0.036	-0.47	-0.67	-0.64	-0.049	-0.76	-0.65	-0.58	-0.042	0.32	-0.8	-0.11	1	0.97	-0.69
highwaympg	0.011	0.035	-0.54	-0.7	-0.68	-0.11	-0.8	-0.68	-0.59	-0.044	0.27	-0.77	-0.054	0.97	1	-0.7
price	-0.11	-0.08	0.58	0.68	0.76	0.12	0.84	0.87	0.55	0.079	0.068	0.81	-0.085	-0.69	-0.7	1

In [10]:

```
predict = "price"
data = data[["symboling", "wheelbase", "carlength",
             "carwidth", "carheight", "curbweight",
             "enginesize", "boreratio", "stroke",
             "compressionratio", "horsepower", "peakrpm",
             "citympg", "highwaympg", "price"]]
x = np.array(data.drop([predict], 1))
y = np.array(data[predict])

from sklearn.model_selection import train_test_split
xtrain, xtest, ytrain, ytest = train_test_split(x, y, test_size=0.2)

from sklearn.tree import DecisionTreeRegressor
model = DecisionTreeRegressor()
model.fit(xtrain, ytrain)
predictions = model.predict(xtest)
```

```
from sklearn.metrics import mean_absolute_error
model.score(xtest, predictions)
```

```
<ipython-input-10-56df943d8afb>:7: FutureWarning: In a future version of pandas all arguments of DataFrame.drop except for the
argument 'labels' will be keyword-only.
  x = np.array(data.drop([predict], 1))
```

```
Out [10]: 1.0
```