
GRAND LEGIT AUTO
AN ANALYSIS OF VALUE
IN AUSTRALIAN VEHICLE PRICES


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In [3]:
```
Supra_options = avp.loc[avp["Model"] == 'Supra']
Supra_options[['Year', 'Model', 'Title', 'Price']]
```

Out[3]:

	Year	Model	Title	Price
7588	2022.0	Supra	2022 Toyota Supra GTS +alcantara Seats	95888
8661	2021.0	Supra	2021 Toyota Supra GTS	97990
12246	2020.0	Supra	2020 Toyota Supra GTS	87990
12261	2021.0	Supra	2021 Toyota Supra GTS +alcantara Seats	94995
15491	2023.0	Supra	2023 Toyota Supra GTS +alcant Seats +matte Paint	102000
15670	1993.0	Supra	1993 Toyota Supra	69880
15971	1994.0	Supra	1994 Toyota Supra TURBO 1994	77888

In [5]:
```
avp.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 16734 entries, 0 to 16733
Data columns (total 19 columns):
 #   Column             Non-Null Count  Dtype  
---  ------             --------------  -----  
 0   Brand              16733 non-null  object 
 1   Year               16733 non-null  float64
 2   Model              16733 non-null  object 
 3   Car/Suv            16706 non-null  object 
 4   Title              16733 non-null  object 
 5   UsedOrNew          16733 non-null  object 
 6   Transmission       16733 non-null  object 
 7   Engine             16733 non-null  object 
 8   DriveType          16733 non-null  object 
 9   FuelType           16733 non-null  object 
 10  FuelConsumption    16733 non-null  object 
 11  Kilometres         16733 non-null  object 
 12  ColourExtInt       16733 non-null  object 
 13  Location           16284 non-null  object 
 14  CylindersinEngine  16733 non-null  object 
 15  BodyType           16452 non-null  object 
 16  Doors              15130 non-null  object 
 17  Seats              15029 non-null  object 
 18  Price              16731 non-null  object 
dtypes: float64(1), object(18)
memory usage: 2.4+ MB
```

Value for Money

$$= \frac{\text{Price}}{\text{Fuel Consumption}}$$

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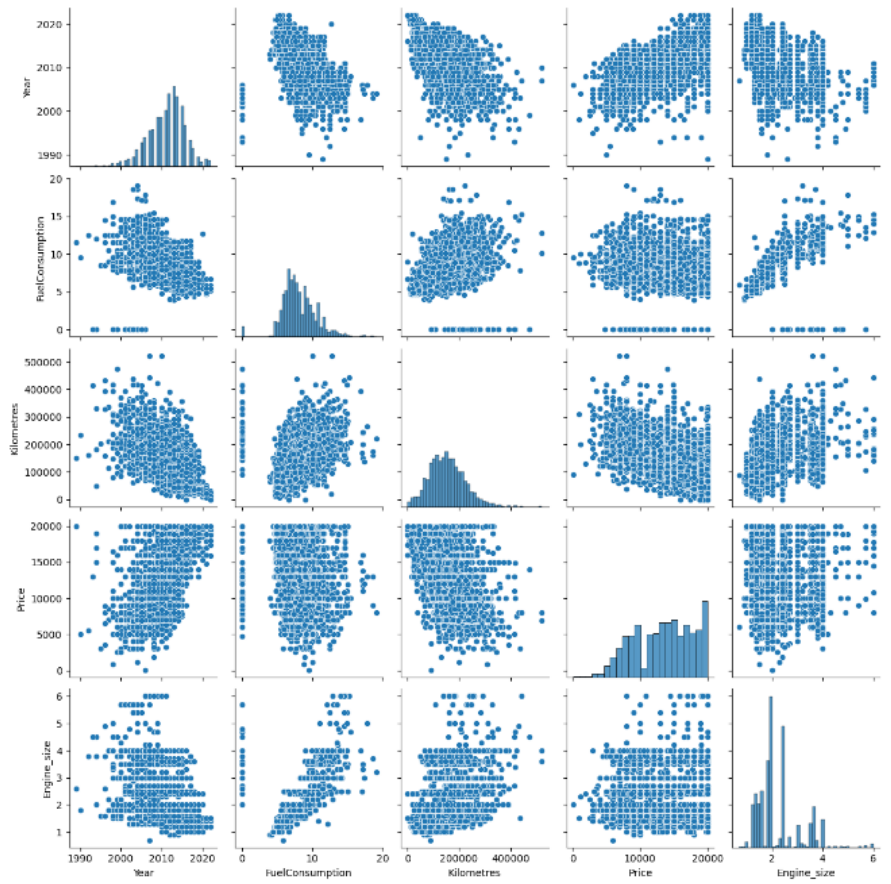
```
import matplotlib.pyplot as plt
import seaborn as sns
import warnings
warnings.filterwarnings('ignore')
```

```
sns.pairplot(avp)
plt.show()
```



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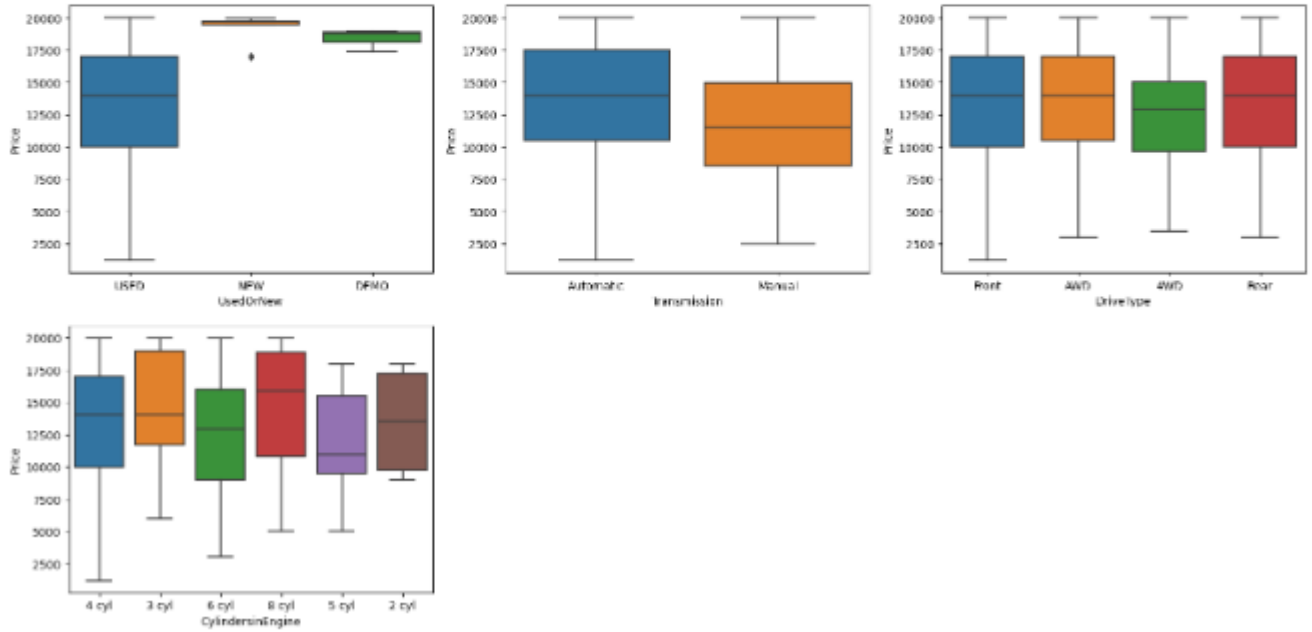
In [29]:
```
avp = avp.drop(avp[avp['Price'] < 1000].index)
```

In [30]:
```
plt.figure(figsize=(20, 20))

plt.subplot(4,3,1)
sns.boxplot(x = 'UsedOrNew', y = 'Price', data = avp)
plt.subplot(4,3,2)
sns.boxplot(x = 'Transmission', y = 'Price', data = avp)
plt.subplot(4,3,3)
sns.boxplot(x = 'DriveType', y = 'Price', data = avp)
plt.subplot(4,3,4)
sns.boxplot(x = 'CylindersinEngine', y = 'Price', data = avp)

plt.show()
```



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1st Iteration

Fit OLS Regression Model

```
In [48]: import statsmodels.api as
```

```
In [49]: # Add constant term to th
         X_train_model1 = sm.add_c

         # Fit OLS model
         ols_model1 = sm.OLS(y_tra
         ols_results1 = ols_model1

         # Print summary of the OL
         print(ols_results1.summar
```

```
==========================
Dep. Variable:
Model:
Method:                 L
Date:                Wed,
Time:
No. Observations:
Df Residuals:
Df Model:
Covariance Type:
==========================

--------------------------
const                    .
log_Year
log_Kilometres
log_Engine_size
Transmission_Manual
DriveType_AWD
DriveType_Front
DriveType_Rear
CylindersinEngine_3 cyl
CylindersinEngine_4 cyl
CylindersinEngine_5 cyl
CylindersinEngine_6 cyl
CylindersinEngine_8 cyl
==========================
Omnibus:
Prob(Omnibus):
Skew:
Kurtosis:
==========================

Notes:
[1] Standard Errors assum
[2] The condition number
strong multicollinearity
```

2nd Iteration

```
In [53]: # Fit OLS model
         ols_model2 = sm
         ols_results2 = (

         # Print summary
         print(ols_resul
```

```
==========
Dep. Variable:
Model:
Method:
Date:
Time:
No. Observation:
Df Residuals:
Df Model:
Covariance Type
==========

----------
const
log_Year
log_Kilometres
log_Engine_size
Transmission_Ma
DriveType_AWD
DriveType_Front
DriveType_Rear
CylindersEngi
CylindersEngi
CylindersEngi
CylindersEngi
==========
Omnibus:
Prob(Omnibus):
Skew:
Kurtosis:
==========

Notes:
[1] Standard Er
[2] The conditi
strong multicol
```

3rd Iteration

```
In [55]: # Fit OLS model
         ols_model3 = sm.OLS(y_train, X_train_model3)
         ols_results3 = ols_model3.fit()

         # Print summary of the OLS regression results
         print(ols_results3.summary())
```

```
                            OLS Regression Results
==============================================================================
Dep. Variable:              log_Value   R-squared:                       0.700
Model:                            OLS   Adj. R-squared:                  0.699
Method:                 Least Squares   F-statistic:                     761.4
Date:                Wed, 01 May 2024   Prob (F-statistic):               0.00
Time:                        09:05:47   Log-Likelihood:                -213.18
No. Observations:                2291   AIC:                             442.4
Df Residuals:                    2283   BIC:                             488.2
Df Model:                           7
Covariance Type:            nonrobust
===========================================================================================
                              coef    std err          t      P>|t|      [0.025      0.975]
-------------------------------------------------------------------------------------------
const                   -1125.9484     24.227    -46.475      0.000   -1173.458   -1078.439
log_Year                  149.2425      3.178     46.965      0.000     143.011     155.474
log_Kilometres             -0.1407      0.012    -12.215      0.000      -0.163      -0.118
log_Engine_size            -0.2922      0.027    -10.840      0.000      -0.345      -0.239
Transmission_Manual        -0.0735      0.014     -5.093      0.000      -0.102      -0.045
DriveType_Front            -0.0806      0.015     -5.212      0.000      -0.111      -0.050
CylindersinEngine_4 cyl     0.0405      0.018      2.244      0.025       0.005       0.076
CylindersinEngine_8 cyl     0.2408      0.053      4.515      0.000       0.136       0.345
==============================================================================
Omnibus:                      267.973   Durbin-Watson:                   2.010
Prob(Omnibus):                  0.000   Jarque-Bera (JB):              781.348
Skew:                          -0.616   Prob(JB):                    2.15e-170
Kurtosis:                       5.583   Cond. No.                     6.22e+04
==============================================================================

Notes:
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.
[2] The condition number is large, 6.22e+04. This might indicate that there are
strong multicollinearity or other numerical problems.
```

Variance Inflation Factor

Out[50]:

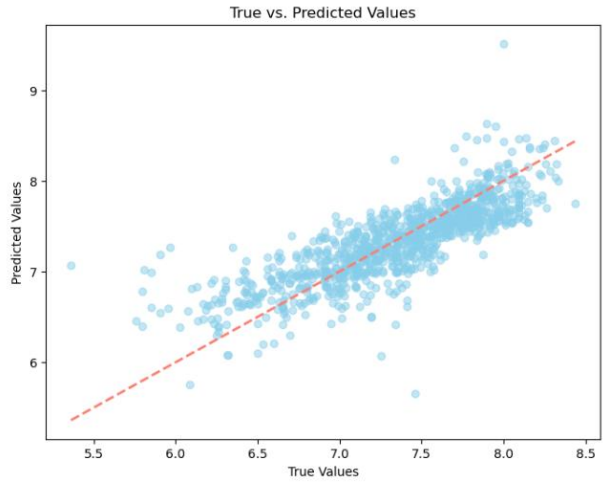
	Features	VIF
0	const	19404227.17
9	CylindersinEngine_4 cyl	399.38
11	CylindersinEngine_6 cyl	350.37
8	CylindersinEngine_3 cyl	50.24
12	CylindersinEngine_8 cyl	29.45
10	CylindersinEngine_5 cyl	9.09
3	log_Engine_size	4.08
6	DriveType_Front	3.88
7	DriveType_Rear	2.49
5	DriveType_AWD	2.05
2	log_Kilometres	1.50
1	log_Year	1.48
4	Transmission_Manual	1.05

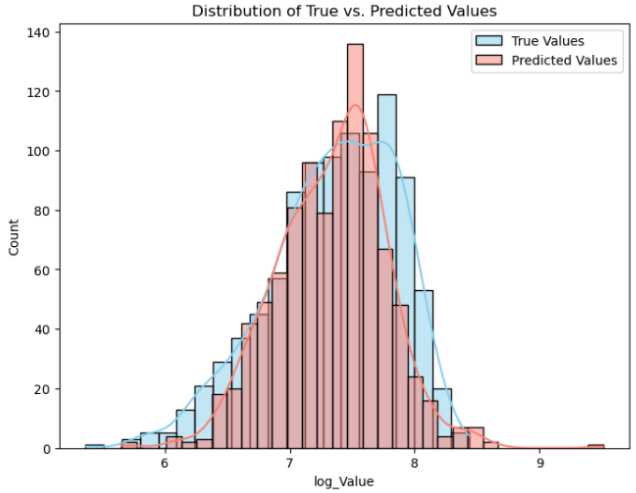
Correlation Coefficient

Out[51]:

pairs	cc
(CylindersinEngine_4 cyl, CylindersinEngine_6 cyl)	0.888923
(log_Engine_size, CylindersinEngine_6 cyl)	0.715344
(CylindersinEngine_4 cyl, log_Engine_size)	0.658813
(DriveType_Front, log_Engine_size)	0.615525
(DriveType_Front, DriveType_Rear)	0.609671
(log_Kilometres, log_Year)	0.506714

Train Model Summary:
Mean Squared Error (MSE) on training data: 0.07052568163676846
R-squared on training data: 0.700096565076077





Test Model Summary:
Mean Squared Error on testing data: 0.2995668811992725
R-squared: 0.6596185666202541

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Findings

1. **Year of Manufacture**

2. **Engine Size**

Further findings

- Avoid manual
- Avoid Front Wheel Drive
- 4 cylinder vehicles

3rd Iteration

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------------------------------------------------------------------------------------------------
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