In [3]:
```python
import pandas as pd
import matplotlib
import matplotlib.pyplot as plt
import numpy as np
import seaborn as sns
%matplotlib inline

import plotly.offline as py
import plotly.graph_objs as go
from plotly.offline import init_notebook_mode
init_notebook_mode(connected=True)
from plotly import tools

import warnings
warnings.filterwarnings("ignore")
warnings.filterwarnings("ignore",category=DeprecationWarning)
```

In [4]:
```python
df= pd.read_csv("https://raw.githubusercontent.com/insaid2018/Term-2/master/Projects/avocado.csv")
```

In [5]:
```python
df.shape
```

Out[5]:
```
(18249, 14)
```

In [6]:
```python
df.columns
```

Out[6]:
```
Index(['Unnamed: 0', 'Date', 'AveragePrice', 'Total Volume', '4046', '4225',
       '4770', 'Total Bags', 'Small Bags', 'Large Bags', 'XLarge Bags', 'type',
       'year', 'region'],
      dtype='object')
```

In [7]:
```python
df.head()
```

Out[7]:

	Unnamed: 0	Date	AveragePrice	Total Volume	4046	4225	4770	Total Bags	Small Bags	Large Bags	XLarge Bags	type	year	region
0	0	2015-12-27	1.33	64236.62	1036.74	54454.85	48.16	8696.87	8603.62	93.25	0.0	conventional	2015	Albany
1	1	2015-12-20	1.35	54876.98	674.28	44638.81	58.33	9505.56	9408.07	97.49	0.0	conventional	2015	Albany
2	2	2015-12-13	0.93	118220.22	794.70	109149.67	130.50	8145.35	8042.21	103.14	0.0	conventional	2015	Albany
3	3	2015-12-06	1.08	78992.15	1132.00	71976.41	72.58	5811.16	5677.40	133.76	0.0	conventional	2015	Albany
4	4	2015-11-29	1.28	51039.60	941.48	43838.39	75.78	6183.95	5986.26	197.69	0.0	conventional	2015	Albany

In [8]:
```python
df.tail()
```

Out[8]:

	Unnamed: 0	Date	AveragePrice	Total Volume	4046	4225	4770	Total Bags	Small Bags	Large Bags	XLarge Bags	type	year	region
18244	7	2018-02-04	1.63	17074.83	2046.96	1529.20	0.00	13498.67	13066.82	431.85	0.0	organic	2018	WestTexNewMexico
18245	8	2018-01-28	1.71	13888.04	1191.70	3431.50	0.00	9264.84	8940.04	324.80	0.0	organic	2018	WestTexNewMexico
18246	9	2018-01-21	1.87	13766.76	1191.92	2452.79	727.94	9394.11	9351.80	42.31	0.0	organic	2018	WestTexNewMexico
18247	10	2018-01-14	1.93	16205.22	1527.63	2981.04	727.01	10969.54	10919.54	50.00	0.0	organic	2018	WestTexNewMexico
18248	11	2018-01-07	1.62	17489.58	2894.77	2356.13	224.53	12014.15	11988.14	26.01	0.0	organic	2018	WestTexNewMexico

In [9]:
```python
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 18249 entries, 0 to 18248
Data columns (total 14 columns):
 #   Column        Non-Null Count  Dtype  
---  ------        --------------  -----  
 0   Unnamed: 0    18249 non-null  int64  
 1   Date          18249 non-null  object 
 2   AveragePrice  18249 non-null  float64
 3   Total Volume  18249 non-null  float64
 4   4046          18249 non-null  float64
 5   4225          18249 non-null  float64
 6   4770          18249 non-null  float64
 7   Total Bags    18249 non-null  float64
 8   Small Bags    18249 non-null  float64
 9   Large Bags    18249 non-null  float64
 10  XLarge Bags   18249 non-null  float64
 11  type          18249 non-null  object 
 12  year          18249 non-null  int64  
 13  region        18249 non-null  object 
dtypes: float64(9), int64(2), object(3)
memory usage: 1.9+ MB
```

In [10]:
```python
df.describe()
```

Out[10]:

	Unnamed: 0	AveragePrice	Total Volume	4046	4225	4770	Total Bags	Small Bags	Large Bags	XLarge Bags	year
count	18249.000000	18249.000000	1.824900e+04	1.824900e+04	1.824900e+04	1.824900e+04	1.824900e+04	1.824900e+04	1.824900e+04	18249.000000	18249.000000
mean	24.232232	1.405978	8.506440e+05	2.930084e+05	2.951546e+05	2.283974e+04	2.396392e+05	1.821947e+05	5.433809e+04	3106.426507	2016.147899
std	15.481045	0.402677	3.453545e+06	1.264989e+06	1.204120e+06	1.074641e+05	9.862424e+05	7.461785e+05	2.439660e+05	17692.894652	0.939938
min	0.000000	0.440000	8.456000e+01	0.000000e+00	0.000000e+00	0.000000e+00	0.000000e+00	0.000000e+00	0.000000e+00	0.000000	2015.000000
25%	10.000000	1.100000	1.083858e+04	8.540700e+02	3.008780e+03	0.000000e+00	5.088640e+03	2.849420e+03	1.274700e+02	0.000000	2015.000000
50%	24.000000	1.370000	1.073768e+05	8.645300e+03	2.906102e+04	1.849900e+02	3.974383e+04	2.636282e+04	2.647710e+03	0.000000	2016.000000
75%	38.000000	1.660000	4.329623e+05	1.110202e+05	1.502069e+05	6.243420e+03	1.107834e+05	8.333767e+04	2.202925e+04	132.500000	2017.000000
max	52.000000	3.250000	6.250565e+07	2.274362e+07	2.047057e+07	2.546439e+06	1.937313e+07	1.338459e+07	5.719097e+06	551693.650000	2018.000000

In [11]:
```python
df.isnull().sum()
```

Out[11]:
```
Unnamed: 0      0
Date            0
AveragePrice    0
Total Volume    0
4046            0
4225            0
4770            0
Total Bags      0
Small Bags      0
Large Bags      0
XLarge Bags     0
type            0
year            0
region          0
dtype: int64
```

In [12]:
```python
df.drop('Unnamed: 0',axis=1,inplace=True)
```

In [13]:
```python
df.head()
```

Out[13]:

	Date	AveragePrice	Total Volume	4046	4225	4770	Total Bags	Small Bags	Large Bags	XLarge Bags	type	year	region
0	2015-12-27	1.33	64236.62	1036.74	54454.85	48.16	8696.87	8603.62	93.25	0.0	conventional	2015	Albany
1	2015-12-20	1.35	54876.98	674.28	44638.81	58.33	9505.56	9408.07	97.49	0.0	conventional	2015	Albany
2	2015-12-13	0.93	118220.22	794.70	109149.67	130.50	8145.35	8042.21	103.14	0.0	conventional	2015	Albany
3	2015-12-06	1.08	78992.15	1132.00	71976.41	72.58	5811.16	5677.40	133.76	0.0	conventional	2015	Albany
4	2015-11-29	1.28	51039.60	941.48	43838.39	75.78	6183.95	5986.26	197.69	0.0	conventional	2015	Albany

In [14]:
```python
df['Date']=pd.to_datetime(df['Date'])
df['Month']=df['Date'].apply(lambda x:x.month)
df['Day']=df['Date'].apply(lambda x:x.day)
```

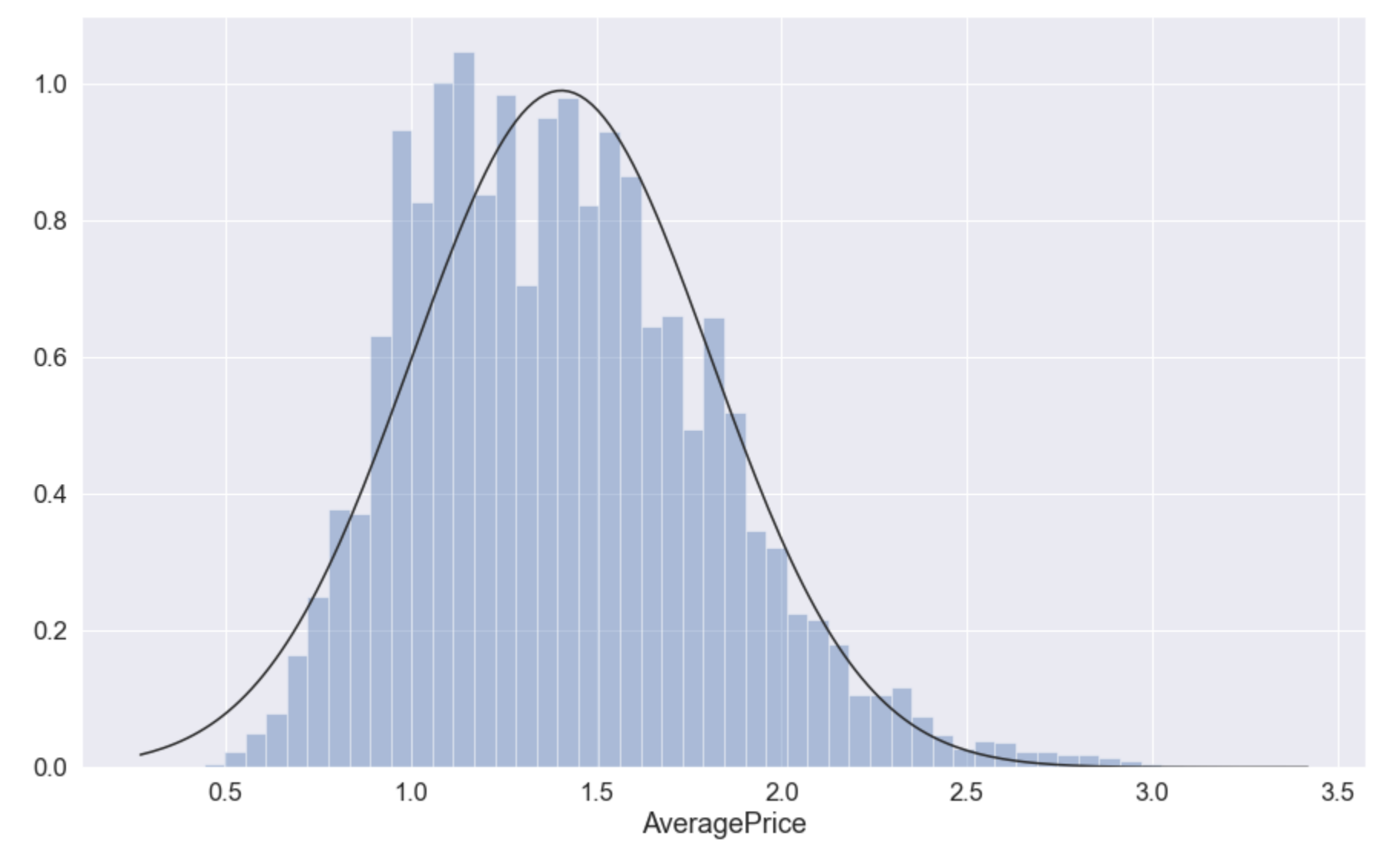
In [15]:
```python
df.head()
```

Out[15]:

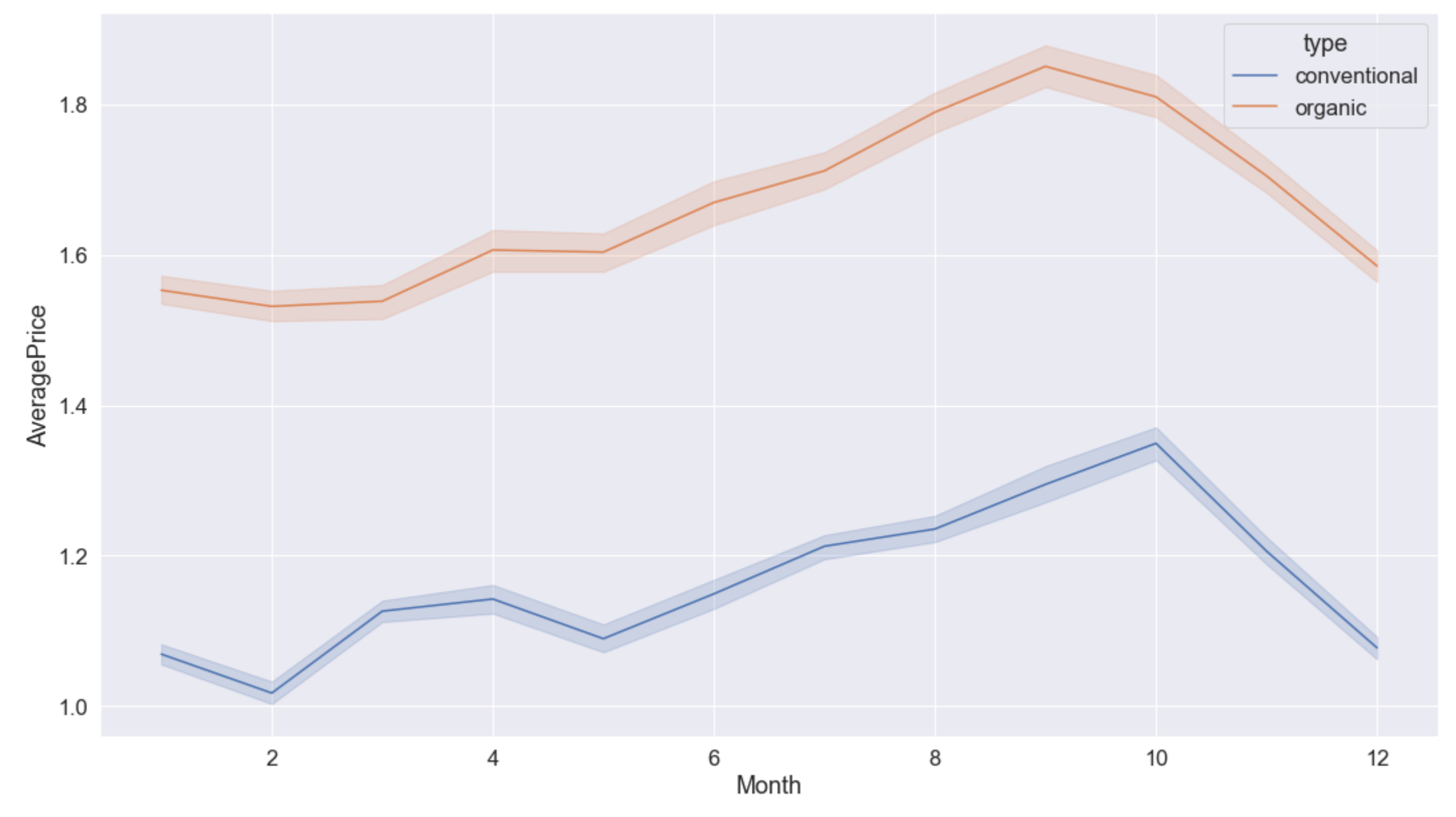
	Date	AveragePrice	Total Volume	4046	4225	4770	Total Bags	Small Bags	Large Bags	XLarge Bags	type	year	region	Month	Day
0	2015-12-27	1.33	64236.62	1036.74	54454.85	48.16	8696.87	8603.62	93.25	0.0	conventional	2015	Albany	12	27
1	2015-12-20	1.35	54876.98	674.28	44638.81	58.33	9505.56	9408.07	97.49	0.0	conventional	2015	Albany	12	20
2	2015-12-13	0.93	118220.22	794.70	109149.67	130.50	8145.35	8042.21	103.14	0.0	conventional	2015	Albany	12	13
3	2015-12-06	1.08	78992.15	1132.00	71976.41	72.58	5811.16	5677.40	133.76	0.0	conventional	2015	Albany	12	6
4	2015-11-29	1.28	51039.60	941.48	43838.39	75.78	6183.95	5986.26	197.69	0.0	conventional	2015	Albany	11	29

In [18]:
```python
sns.set(font_scale=1.5)
from scipy.stats import norm
fig, ax = plt.subplots(figsize=(15, 9))
sns.distplot(a=df.AveragePrice, kde=False, fit=norm)
```

Out[18]:
```
<AxesSubplot:xlabel='AveragePrice'>
```

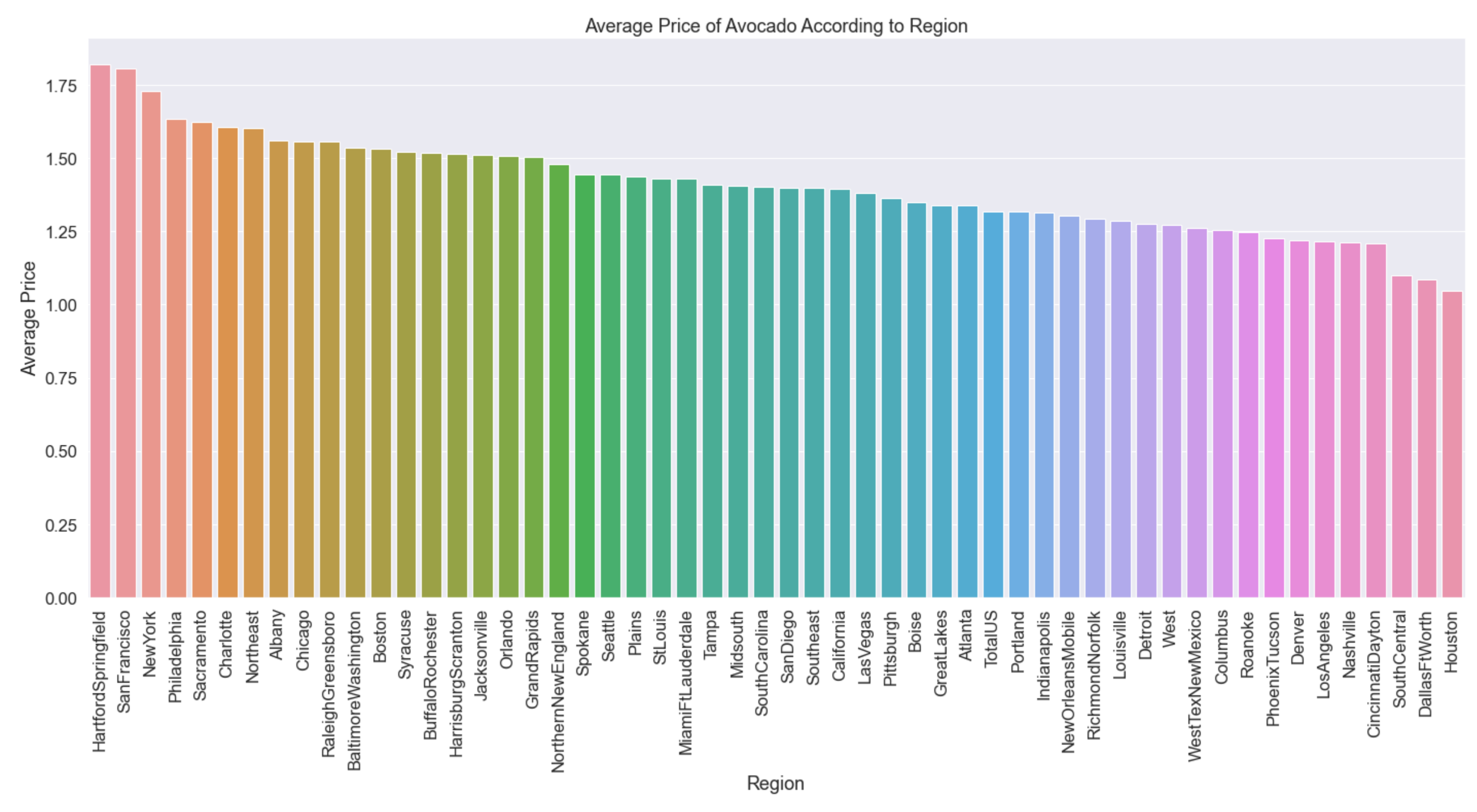


In [19]:
```python
plt.figure(figsize=(18,10))
sns.lineplot(x="Month", y="AveragePrice", hue='type', data=df)
plt.show()
```



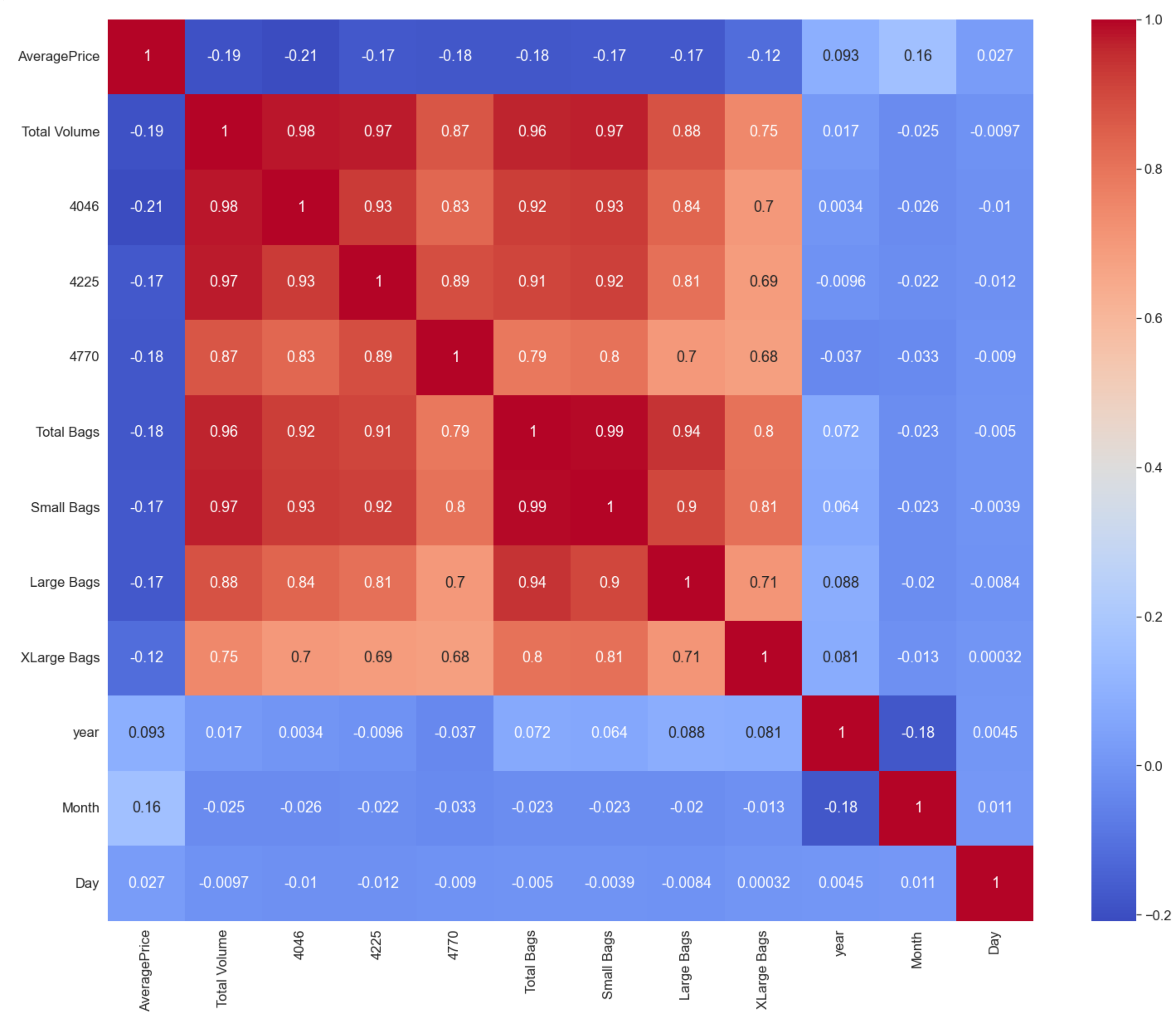
In [20]:
```python
region_list=list(df.region.unique())
average_price=[]

for i in region_list:
    x=df[df.region==i]
    region_average=sum(x.AveragePrice)/len(x)
    average_price.append(region_average)

df1=pd.DataFrame({'region_list':region_list,'average_price':average_price})
new_index=df1.average_price.sort_values(ascending=False).index.values
sorted_data=df1.reindex(new_index)

plt.figure(figsize=(24,10))
ax=sns.barplot(x=sorted_data.region_list,y=sorted_data.average_price)

plt.xticks(rotation=90)
plt.xlabel('Region')
plt.ylabel('Average Price')
plt.title('Average Price of Avocado According to Region')
```

Out[20]:
```
Text(0.5, 1.0, 'Average Price of Avocado According to Region')
```



In [22]:
```python
plt.figure(figsize=(25,20))
sns.heatmap(df.corr(),cmap='coolwarm',annot=True)
```

Out[22]:
```
<AxesSubplot:>
```



In [23]:
```python
df['region'].nunique()
```

Out[23]:
```
54
```

In [24]:
```python
df_final=pd.get_dummies(df.drop(['region','Date'],axis=1),drop_first=True)
```

In [25]:
```python
df_final.head()
```

Out[25]:

	AveragePrice	Total Volume	4046	4225	4770	Total Bags	Small Bags	Large Bags	XLarge Bags	year	Month	Day	type_organic
0	1.33	64236.62	1036.74	54454.85	48.16	8696.87	8603.62	93.25	0.0	2015	12	27	0
1	1.35	54876.98	674.28	44638.81	58.33	9505.56	9408.07	97.49	0.0	2015	12	20	0
2	0.93	118220.22	794.70	109149.67	130.50	8145.35	8042.21	103.14	0.0	2015	12	13	0
3	1.08	78992.15	1132.00	71976.41	72.58	5811.16	5677.40	133.76	0.0	2015	12	6	0
4	1.28	51039.60	941.48	43838.39	75.78	6183.95	5986.26	197.69	0.0	2015	11	29	0

In [26]:
```python
X=df_final.iloc[:,1:14]
y=df_final['AveragePrice']
from sklearn.model_selection import train_test_split
X_train,X_test,y_train,y_test=train_test_split(X,y,test_size=0.2,random_state=42)
```

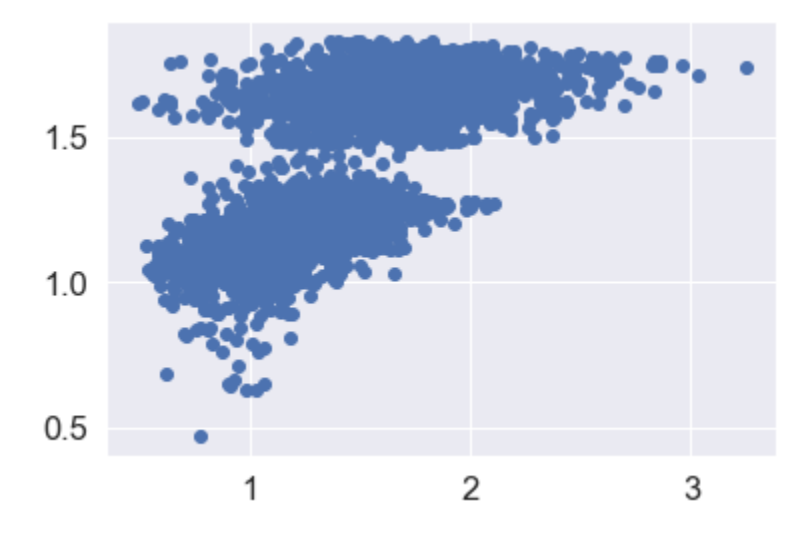
In [27]:
```python
from sklearn.linear_model import LinearRegression
lr=LinearRegression()
lr.fit(X_train,y_train)
pred=lr.predict(X_test)
```

In [28]:
```python
from sklearn import metrics
print('MAE:', metrics.mean_absolute_error(y_test, pred))
print('MSE:', metrics.mean_squared_error(y_test, pred))
print('RMSE:', np.sqrt(metrics.mean_squared_error(y_test, pred)))
```

```
MAE: 0.23297133291603161
MSE: 0.09108802805318916
RMSE: 0.30180793238944065
```

In [29]:
```python
plt.scatter(x=y_test,y=pred)
```

Out[29]:
```
<matplotlib.collections.PathCollection at 0x1d40b5dd5e0>
```



In [30]:
```python
from sklearn.tree import DecisionTreeRegressor
dtr=DecisionTreeRegressor()
dtr.fit(X_train,y_train)
pred=dtr.predict(X_test)
```

In [31]:
```python
plt.scatter(x=y_test,y=pred)
plt.xlabel('Y Test')
plt.ylabel('Predicted Y')
```

Out[31]:
```
Text(0, 0.5, 'Predicted Y')
```

In [32]:
```python
print('MAE:', metrics.mean_absolute_error(y_test, pred))
print('MSE:', metrics.mean_squared_error(y_test, pred))
print('RMSE:', np.sqrt(metrics.mean_squared_error(y_test, pred)))
```

```
MAE: 0.1369753424657534
MSE: 0.045329808219178085
RMSE: 0.21290798063759395
```

In [33]:
```python
from sklearn.ensemble import RandomForestRegressor
rdr = RandomForestRegressor()
rdr.fit(X_train,y_train)
pred=rdr.predict(X_test)
```

In [34]:
```python
print('MAE:', metrics.mean_absolute_error(y_test, pred))
print('MSE:', metrics.mean_squared_error(y_test, pred))
print('RMSE:', np.sqrt(metrics.mean_squared_error(y_test, pred)))
```

```
MAE: 0.09958435616438355
MSE: 0.021068970041095886
RMSE: 0.14515154164216063
```

In [35]:
```python
data = pd.DataFrame({'Y Test':y_test , 'Pred':pred},columns=['Y Test','Pred'])
sns.lmplot(x='Y Test',y='Pred',data=data,palette='rainbow')
data.head()
```

Out[35]:

	Y Test	Pred
8604	0.82	0.9329
2608	0.97	0.9843
14581	1.44	1.3877
4254	0.97	0.9038
16588	1.45	1.4580