BoxOffice_Rev_Prediction

November 9, 2021

[295]:

```python
from IPython.display import set_matplotlib_formats
set_matplotlib_formats('pdf', 'svg')
```

[296]:

```python
from google.colab import drive
drive.mount('/content/drive')
```

```
Drive already mounted at /content/drive; to attempt to forcibly remount, call
drive.mount("/content/drive", force_remount=True).
```

[298]:

```python
import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt
import plotly.express as px
import plotly.graph_objects as go
import time
from datetime import datetime
import math
from statistics import median

%matplotlib inline

import warnings
warnings.filterwarnings("ignore")

#Loading the dataset and looking at the data types in the dataset
movies = pd.read_csv('/content/drive/MyDrive/Colab Notebooks/Data/
 ↪Mojo_budget_update.csv')
movies.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 3243 entries, 0 to 3242
Data columns (total 26 columns):
 #   Column            Non-Null Count  Dtype
---  ------            --------------  -----
 0   movie_id          3243 non-null   object
 1   title             3243 non-null   object
 2   year             3243 non-null   int64
 3   trivia           3243 non-null   object
 4   mpaa             3082 non-null   object
 5   release_date     3242 non-null   object
 6   run_time         3243 non-null   object
 7   distributor      3228 non-null   object
 8   director         3243 non-null   object
 9   writer           3234 non-null   object
 10  producer         3230 non-null   object
 11  composer         3138 non-null   object
 12  cinematographer  3129 non-null   object
 13  main_actor_1     3243 non-null   object
 14  main_actor_2     3243 non-null   object
 15  main_actor_3     3243 non-null   object
 16  main_actor_4     3240 non-null   object
 17  budget           3243 non-null   float64
 18  domestic         3224 non-null   float64
 19  international    2833 non-null   float64
 20  worldwide        3236 non-null   float64
 21  genre_1          3243 non-null   object
 22  genre_2          2962 non-null   object
 23  genre_3          2221 non-null   object
 24  genre_4          1123 non-null   object
 25  html             3243 non-null   object
dtypes: float64(4), int64(1), object(21)
memory usage: 658.9+ KB
```

[299]:

```python
#Looking at the first 3 rows of the dataset
movies.head(3)
```

[299]:

```
    movie_id  ...                                              html
0  tt0099088  ...  https://www.boxofficemojo.com/title/tt0099088/...
1  tt0099165  ...  https://www.boxofficemojo.com/title/tt0099165/...
2  tt0099348  ...  https://www.boxofficemojo.com/title/tt0099348/...

[3 rows x 26 columns]
```

[300]:

```python
#Checking for duplicates
print('Number of duplicate Movie_ID: {}'.format(movies['movie_id'].duplicated().
 ↪sum()))
```

```
Number of duplicate Movie_ID: 0
```

[301]:

```python
# Checking for null values and their percentage
num_null_values = movies.isnull().sum()
print(num_null_values)
print('----------------------------')
percentage = num_null_values / len(movies)
```

```
print(percentage)
```

```
movie_id              0
title                 0
year                  0
trivia                0
mpaa                161
release_date          1
run_time              0
distributor          15
director              0
writer                9
producer             13
composer            105
cinematographer     114
main_actor_1          0
main_actor_2          0
main_actor_3          0
main_actor_4          3
budget                0
domestic             19
international       410
worldwide             7
genre_1               0
genre_2             281
genre_3            1022
genre_4            2120
html                  0
dtype: int64
----------------------------
movie_id           0.000000
title              0.000000
year               0.000000
trivia             0.000000
mpaa               0.049645
release_date       0.000308
run_time           0.000000
distributor        0.004625
director           0.000000
writer             0.002775
producer           0.004009
composer           0.032377
cinematographer    0.035153
main_actor_1       0.000000
main_actor_2       0.000000
main_actor_3       0.000000
main_actor_4       0.000925
```

```
budget           0.000000
domestic         0.005859
international    0.126426
worldwide        0.002158
genre_1          0.000000
genre_2          0.086648
genre_3          0.315140
genre_4          0.653716
html             0.000000
dtype: float64
```

[302]:

```
#Since there is very few null values for worldwide & distributor, then I will␣
 ↪remove these rows and create a new dataframe

moviesNew = movies.dropna(subset=['worldwide', 'distributor'])
num_null_values = moviesNew.isnull().sum()
num_null_values
```

[302]:

```
movie_id             0
title                0
year                 0
trivia               0
mpaa               156
release_date         0
run_time             0
distributor          0
director             0
writer               9
producer            12
composer           105
cinematographer    114
main_actor_1         0
main_actor_2         0
main_actor_3         0
main_actor_4         3
budget               0
domestic            12
international      403
worldwide            0
genre_1              0
genre_2            271
genre_3           1008
genre_4           2101
html                 0
dtype: int64
```

[303]:

```
#Let us replace the NaN in the domestic and international with 0
```

```
moviesNew['domestic'] = moviesNew['domestic'].fillna(0)
moviesNew['international'] = moviesNew['international'].fillna(0)
num_null_values = moviesNew.isnull().sum()
num_null_values
```

[303]:

```
movie_id             0
title                0
year                 0
trivia               0
mpaa               156
release_date         0
run_time             0
distributor          0
director             0
writer               9
producer            12
composer           105
cinematographer    114
main_actor_1         0
main_actor_2         0
main_actor_3         0
main_actor_4         3
budget               0
domestic             0
international        0
worldwide            0
genre_1              0
genre_2            271
genre_3           1008
genre_4           2101
html                 0
dtype: int64
```

[304]:

```
#I will then replace the NaN in the mpaa with the most common PG-13

print(moviesNew['mpaa'].value_counts().head())        #Printing the MPAA counts␣
 ↪before replacement
moviesNew['mpaa'] = moviesNew['mpaa'].fillna('PG-13')
print('-----------------------------------')
print(moviesNew['mpaa'].value_counts().head())        #Printing the MPAA counts␣
 ↪after replacement
```

```
R        1340
PG-13    1221
PG        476
G          22
NC-17       6
Name: mpaa, dtype: int64
```

```
----------------------------------
PG-13    1377
R        1340
PG        476
G          22
NC-17       6
Name: mpaa, dtype: int64
```

[305]:

```
# I can delete the following columns as they are irrelvant to my analysis
# writer, producer, composer, cinematographer & html

moviesNew.drop(['writer','producer','composer', 'cinematographer', 'html'],␣
 ↪axis='columns', inplace=True)
moviesNew.head(3)
```

[305]:

```
    movie_id                        title  year  ... genre_2  genre_3  genre_4
0  tt0099088  Back to the Future Part III  1990  ...  Comedy   Sci-Fi  Western
1  tt0099165  The Bonfire of the Vanities  1990  ...   Drama  Romance      NaN
2  tt0099348           Dances with Wolves  1990  ...   Drama  Western      NaN

[3 rows x 21 columns]
```

[306]:

```
# Since there is only 3 missing names under main_actor_4, then I can fill them␣
 ↪with 'No Actor'

moviesNew['main_actor_4'] = moviesNew['main_actor_4'].fillna('No Actor')
moviesNew[moviesNew['main_actor_4'] == 'No Actor']
```

[306]:

```
       movie_id                        title  ...   genre_3  genre_4
2769  tt2276023  The United States of Autism  ...    Family     News
2812  tt2401878                    Anomalisa  ...     Drama  Romance
3026  tt4218572                       Widows  ...  Thriller      NaN

[3 rows x 21 columns]
```

[307]:

```
#Renaming some columns to improve the readability of the dataset

#pd.set_option('display.float_format', '${0:,.2f}'.format)
moviesNew = moviesNew.rename(columns={"domestic": "Domestic_Revenue",␣
 ↪"international": "International_Revenue", "worldwide": "Worldwide_Revenue"})
moviesNew.head(3)
```

[307]:

```
    movie_id                        title  year  ... genre_2  genre_3  genre_4
0  tt0099088  Back to the Future Part III  1990  ...  Comedy   Sci-Fi  Western
1  tt0099165  The Bonfire of the Vanities  1990  ...   Drama  Romance      NaN
2  tt0099348           Dances with Wolves  1990  ...   Drama  Western      NaN

[3 rows x 21 columns]
```

[308]:
```
moviesNew.describe()

# Some findings:
# 1. The average Worldwide Revenue is $139,757,500
# 2. The highest Worldwide Revenue is $2,797,801,000
# 3. The average Budget is $46,396,300
# 4. The highest Budget is $356,000,000
# 5. The movies in the dataset are between the year 1990 and 2020
```

[308]:
```
              year        budget  ...  International_Revenue  Worldwide_Revenue
count  3221.000000  3.221000e+03  ...           3.221000e+03       3.221000e+03
mean   2006.656007  4.639630e+07  ...           7.827260e+07       1.397575e+08
std       7.221364  4.714060e+07  ...           1.434407e+08       2.165638e+08
min    1990.000000  2.200000e+02  ...           0.000000e+00       3.000000e+01
25%    2001.000000  1.400000e+07  ...           2.543849e+06       1.912640e+07
50%    2007.000000  3.000000e+07  ...           2.509637e+07       6.267510e+07
75%    2012.000000  6.200000e+07  ...           8.750000e+07       1.698528e+08
max    2020.000000  3.560000e+08  ...           2.029931e+09       2.797801e+09

[8 rows x 5 columns]
```

[309]:
```
cols = ['movie_id', 'title', 'year', 'Worldwide_Revenue']
lowestRev = moviesNew.sort_values('Worldwide_Revenue', ascending=True)[cols].
 ↪set_index('movie_id')
lowestRev.head(10)

# 6. The lowest Worldwide Revenue is $30, which is very low, so let us␣
 ↪investigate more and look at the lowest 10 Grossing movies
```

[309]:
```
                                      title  year  Worldwide_Revenue
movie_id
tt0429277                         Zyzzyx Rd  2006               30.0
tt1019449  The Rise and Fall of Miss Thang  2007              581.0
tt1235168                   Redneck Carnage  2009              706.0
tt0431155                            Issues  2005              783.0
tt0387057                     Beat the Drum  2003              895.0
tt0102032                       High Strung  1992              904.0
tt1735485                        The Tunnel  2011             1532.0
tt0396587                              FAQs  2005             1967.0
tt2382420          Split: A Deeper Divide  2012             2000.0
tt0120878            The Velocity of Gary  1998             2143.0
```

[310]:
```
# Findings from the above table
# 1. The first movie title dosen't seem correct, so we can delete this record
# 2. After searching the 'www.the-numbers.com' for the rest of the above list:
#   a. The following movies doesn't exist: 'Redneck Carnage', 'Beat the Drum',␣
 ↪'High Strung from 1992', 'The Tunnel from 2011'
#   b. 'The Velocity of Gary' movie has an incorrect Worldwide Revenue
# 3. So to fix these problems, I choose to delete all records that has␣
 ↪Worldwide Revenue less than $100,000

# Get indexes where Worldwide Revenue column is less than $100,000
indexRev = moviesNew[ moviesNew['Worldwide_Revenue'] < 100000 ].index

# Delete these row indexes from the dataframe

moviesNew.drop(indexRev, inplace=True)

cols = ['movie_id', 'title', 'year', 'Worldwide_Revenue', 'budget']
lowestRev = moviesNew.sort_values('Worldwide_Revenue', ascending=True)[cols].
 ↪set_index('movie_id')
lowestRev.head(10)
```

[310]:

```
                                                title  ...      budget
movie_id                                               ...
tt2276023                The United States of Autism  ...     65000.0
tt1247662                               The Good Guy  ...  10000000.0
tt0478262  Return with Honor: A Missionary Homecoming  ...    300000.0
tt0262911                             World Traveler  ...   2000000.0
tt0119506                                  Lawn Dogs  ...   8000000.0
tt1210039                      Blood Done Sign My Name  ...  10000000.0
tt0102898                            Shakes the Clown  ...   1400000.0
tt0156096                             Spring Forward  ...   2000000.0
tt1161418                          Gentlemen Broncos  ...  10000000.0
tt0252223                        All the Queen's Men  ...  15000000.0

[10 rows x 4 columns]
```

[311]:

```
moviesNew.describe(include='object')

# Some observations from the table below
# 1. MPAA: There are 5 different movies rating, with the most frequent one is␣
 ↪PG-13
# 2. Ditributor: There are 157 different production companies, Warner Bros. is␣
 ↪the top with 388 movies
# 3. Main Actor 1: Adam Sandler top the list with 27 movies
# 4. Main Actor 2: Samuel L. Jackson top this list with 15 movies
# 5. The most frequent Genres are 'Action' and 'Drama'
```

[311]:

```
         movie_id     title         trivia  ... genre_2   genre_3   genre_4
count        3151      3151           3151  ...    2906      2188      1116
unique       3151      3125           3147  ...      20        20        17
top     tt0253798  Hercules  The story of  ...   Drama  Thriller  Thriller
freq            1         2              4  ...     747       382       356

[4 rows x 16 columns]
```

[312]:

```
#Let us look at the Top 20 movies based on Worldwide Revenue with release year

cols = ['title', 'Worldwide_Revenue', 'year']
revenueData = moviesNew.sort_values('Worldwide_Revenue', ascending=False)[cols].
 ↪set_index('title')
top_20_revenue = revenueData.head(20)

fig = px.bar(top_20_revenue, x=top_20_revenue.index, y='Worldwide_Revenue',␣
 ↪text='year', title = 'Top 20 Revenue Movies', color = 'Worldwide_Revenue',␣
 ↪height=600, width=1000,
             labels={'Worldwide_Revenue':'Global Revenue in USD Billion',  'x':
 ↪''})
fig.update_traces(textposition = 'outside')
fig.show()

# Avengers:Endgame which was released in 2019 recorded the highest Global␣
 ↪Revenue in the last 30 years
```

[313]:

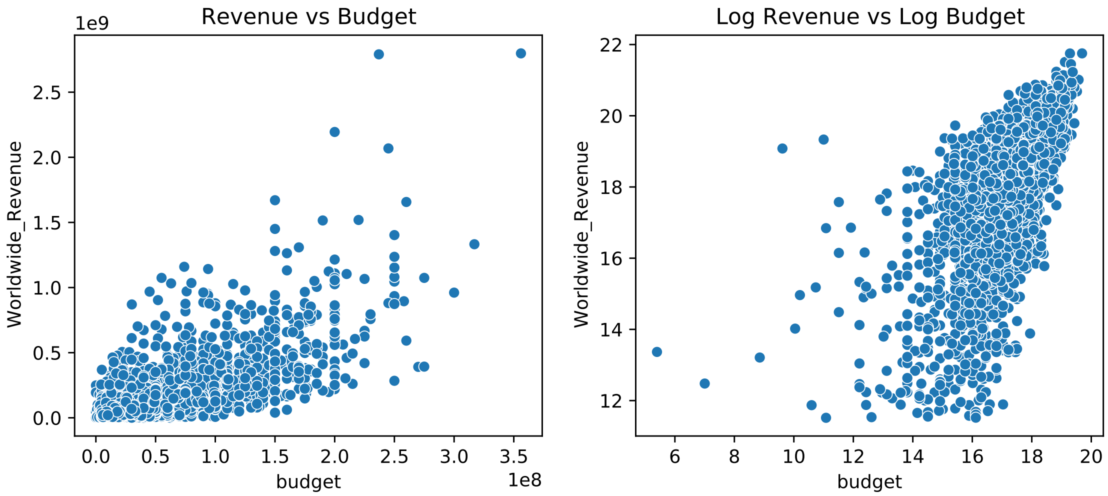
```
#Let us look at the Top 20 movies based on Budget with year of release

cols = ['title', 'budget', 'year']
budgetData = moviesNew.sort_values('budget', ascending=False)[cols].
 ↪set_index('title')
top_20_budget = budgetData.head(20)

fig = px.bar(top_20_budget, x=top_20_budget.index, y='budget', text='year',␣
 ↪title = 'Top 20 Budget Movies', color = 'budget', height=600, width=1000,
             labels={'budget':'Budget in USD Million', 'x':''})
fig.update_traces(textposition = 'outside')
fig.show()

# Avengers:Endgame which was released in 2019 had the highest production cost␣
 ↪in the last 30 years
```

[314]:

```
#Let us look at the Top 20 profitable movies

profitsValue = moviesNew['Worldwide_Revenue'] - moviesNew['budget']
profitsValue.name = 'profit'
profitsData = moviesNew.join(profitsValue)[['title', 'budget',␣
 ↪'Worldwide_Revenue', 'profit']].sort_values('profit', ascending=False)
top_20_profits = profitsData.head(20).set_index('title')

fig = go.Figure()
fig.add_trace(go.Bar(
    x=top_20_profits.index,
    y=profitsData.Worldwide_Revenue,
    name='Global Revenue',
    marker_color='orange'
))
fig.add_trace(go.Bar(
    x=top_20_profits.index,
    y=profitsData.budget,
    name='Budget',
    marker_color='blue'
))
fig.add_trace(go.Bar(
    x=top_20_profits.index,
    y=profitsData.profit,
    name='Profit',
    marker_color='purple'
))

fig.update_layout(
    title = 'Top 20 Profitable Movies'
    )
fig.show()

# Avatar recorded the highest profitable movie with over $2.5 USD Billion
```

[315]:

```
#Let us check at the relationship between Revenue and Budget

plt.figure(figsize=(10,4))
plt.subplot(1,2,1)
sns.scatterplot(moviesNew['budget'], moviesNew['Worldwide_Revenue'])
plt.title('Revenue vs Budget');

#I will aslo check at the relationship using the log transformation to make the␣
 ↪data look more normal
plt.subplot(1,2,2)
sns.scatterplot(np.log1p(moviesNew['budget']), np.
 ↪log1p(moviesNew['Worldwide_Revenue']))
plt.title('Log Revenue vs Log Budget');
```



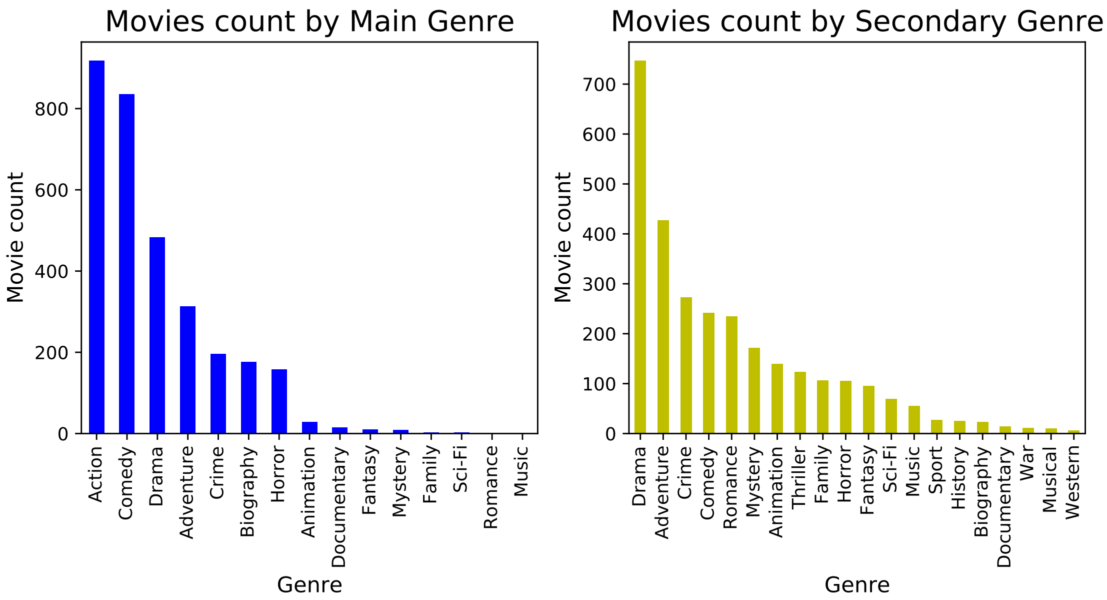
[316]:

```
# Analysis of correlation
from scipy.stats import pearsonr

corr, _ = pearsonr(moviesNew['budget'], moviesNew['Worldwide_Revenue'])
print('Pearsons correlation between budget and Worldwide Revenue: %.3f' % corr)

corr, _ = pearsonr(np.log1p(moviesNew['budget']), np.
 ↪log1p(moviesNew['Worldwide_Revenue']))
print('Pearsons correlation between log transformed budget and log transformed␣
 ↪revenue: %.3f' % corr)

#We can see there is a strong positive correlation between Budget and Worldwide␣
 ↪Revenue
```

```
Pearsons correlation between budget and Worldwide Revenue: 0.717
Pearsons correlation between log transformed budget and log transformed revenue:
0.665
```

[317]:

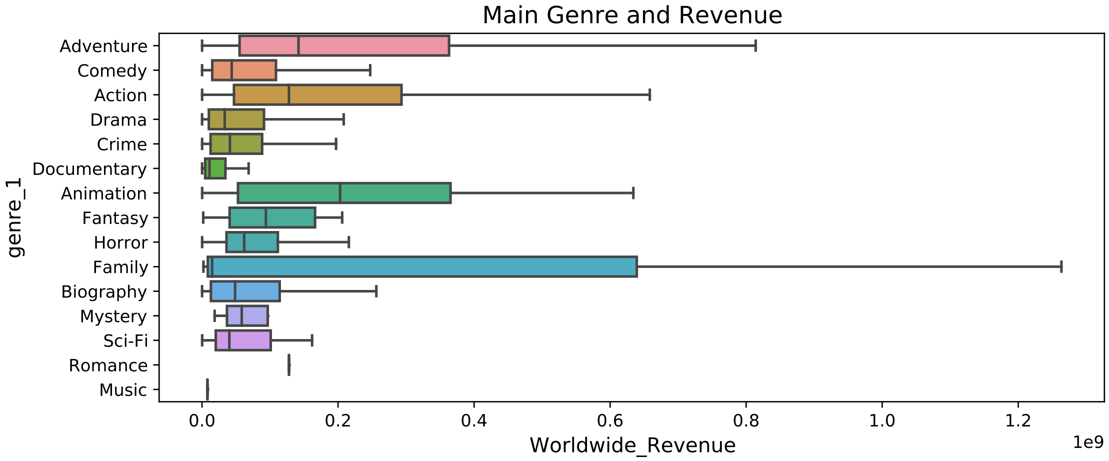
```
#Checking the movies count per Genre

plt.figure(figsize=(10,4))
plt.subplot(1,2,1)
moviesNew['genre_1'].value_counts().plot(kind='bar', color='b');
plt.title('Movies count by Main Genre', size=16)
plt.xlabel('Genre', size=12)
plt.ylabel('Movie count', size=12);

plt.subplot(1,2,2)
moviesNew['genre_2'].value_counts().plot(kind='bar', color='y');
plt.title('Movies count by Secondary Genre', size=16)
plt.xlabel('Genre', size=12)
plt.ylabel('Movie count', size=12);

# Top movies released was for Genre 'Action', 'Comedy', 'Drama', and 'Adventure
```

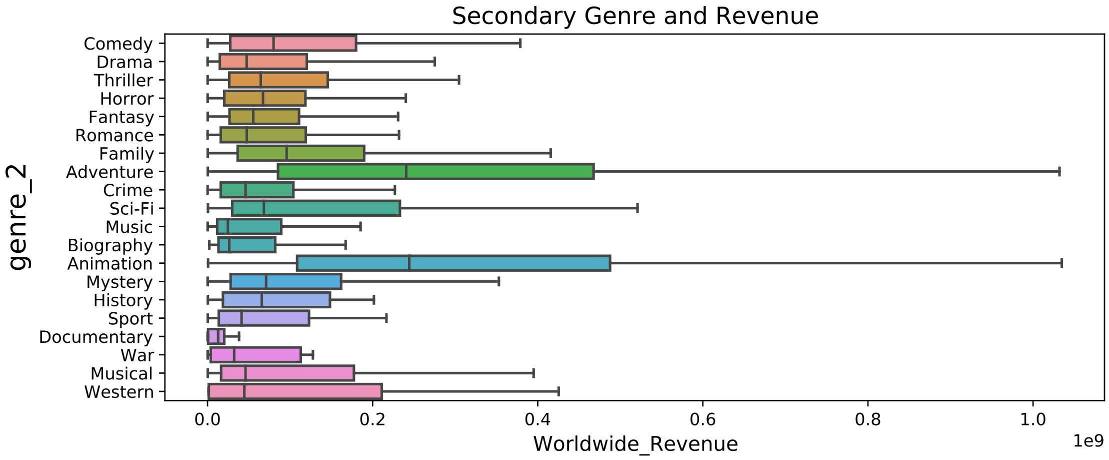


[318]:

```
#Looking at the (Genre 1 and Genre 2) and Revenue

fig, ax = plt.subplots(figsize=(10, 4))
ax.tick_params(axis='both', labelsize=10)
plt.title('Main Genre and Revenue', fontsize=14)
plt.xlabel('Worldwide Revenue', fontsize=12)
plt.ylabel('Main Genre', fontsize=12)
sns.boxplot(ax=ax, x=moviesNew.Worldwide_Revenue, y=moviesNew.genre_1,␣
 ↪showfliers=False, orient='h')
plt.show();

fig, ax = plt.subplots(figsize=(10, 4))
ax.tick_params(axis='both', labelsize=10)
plt.title('Secondary Genre and Revenue', fontsize=14)
plt.xlabel('Worldwide Revenue', fontsize=12)
plt.ylabel('Secondary Genre', fontsize=16)
sns.boxplot(ax=ax, x=moviesNew.Worldwide_Revenue, y=moviesNew.genre_2,␣
 ↪showfliers=False, orient='h')
plt.show();

#Main genres 'Family, Adventure & Animation' generated the highest worldwide␣
 ↪revenue
```

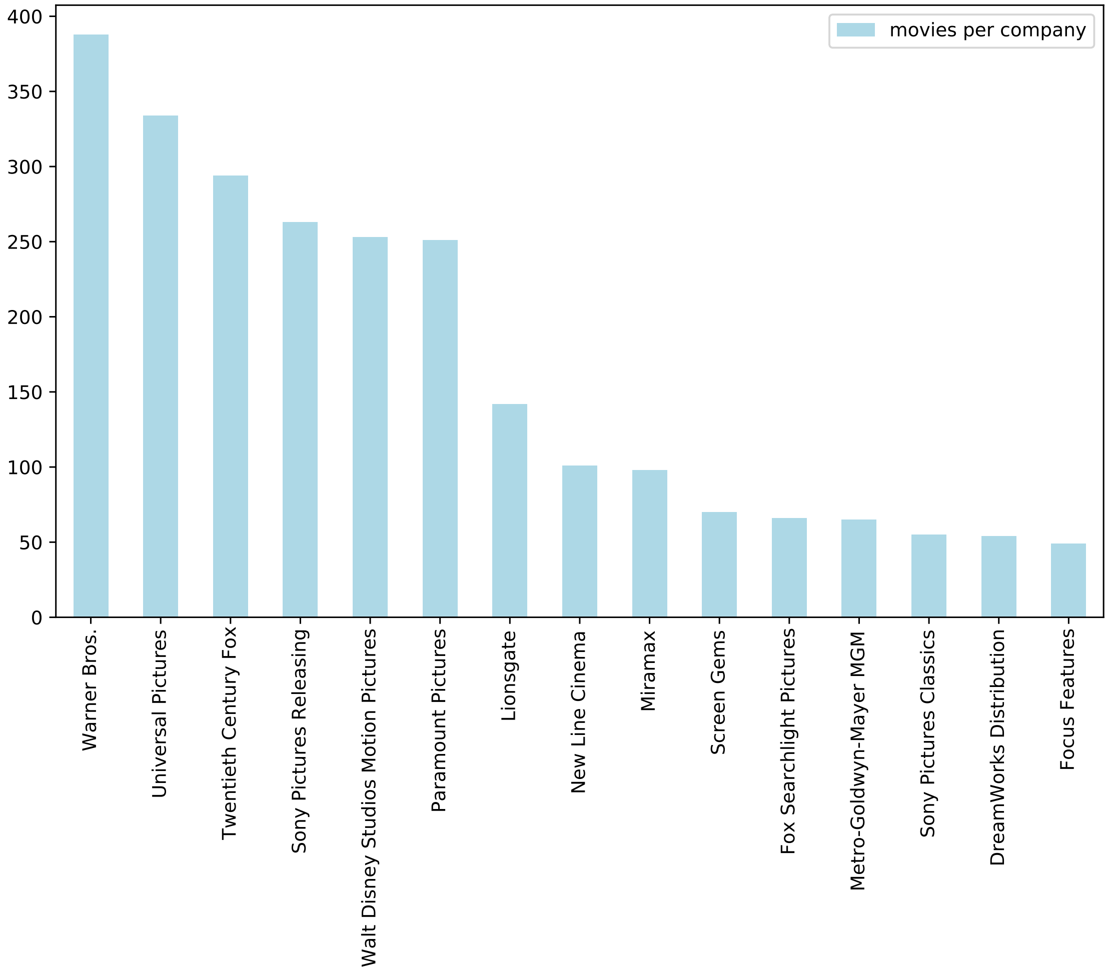
```
#Secondary genres 'Animation, Adventure & Sci-Fi' generated the highest␣
 ↪worldwide revenue
```





[319]:
```
# Distributor Companies

distributorDict = {}
for elem in moviesNew["distributor"].values:
    #for dist in element:
    if elem not in distributorDict:
      distributorDict[elem] = 1
    else:
      distributorDict[elem] += 1
```

```
dist_df = pd.DataFrame.from_dict(distributorDict, orient='index',␣
 ↪columns=["movies per company"])
dist_df.sort_values(by="movies per company", ascending=False).head(15).plot.
 ↪bar(color='lightblue', figsize=(10,6))

dist_df.columns = ["num_of_movies"]

# 'Warner Bros.' has the highest number of movies produced.
```



[320]:
```
# Analysis of Worlwide Revenue with Distributor

# Creating an index for Distributors
dist_df.index.values
for d in dist_df.index.values:
    moviesNew[d] = moviesNew['distributor'].apply(lambda x: 1 if d in x else 0)

# Average revenue per Distributor
```

```
for i, d in enumerate(dist_df.index.values):
    dist_df.loc[d, "avg_revenue"] = moviesNew[moviesNew[d]==1].
 ↪Worldwide_Revenue.mean()

dist_df.sort_values(by=["num_of_movies", "avg_revenue"], ascending=False).
 ↪head(10)

# Total revenue per Distributor
for i, d in enumerate(dist_df.index.values):
    dist_df.loc[d, "total_revenue"] = moviesNew[moviesNew[d]==1].
 ↪Worldwide_Revenue.sum()

dist_df.sort_values(by=["num_of_movies", "total_revenue"], ascending=False).
 ↪head(10)
```

[320]:

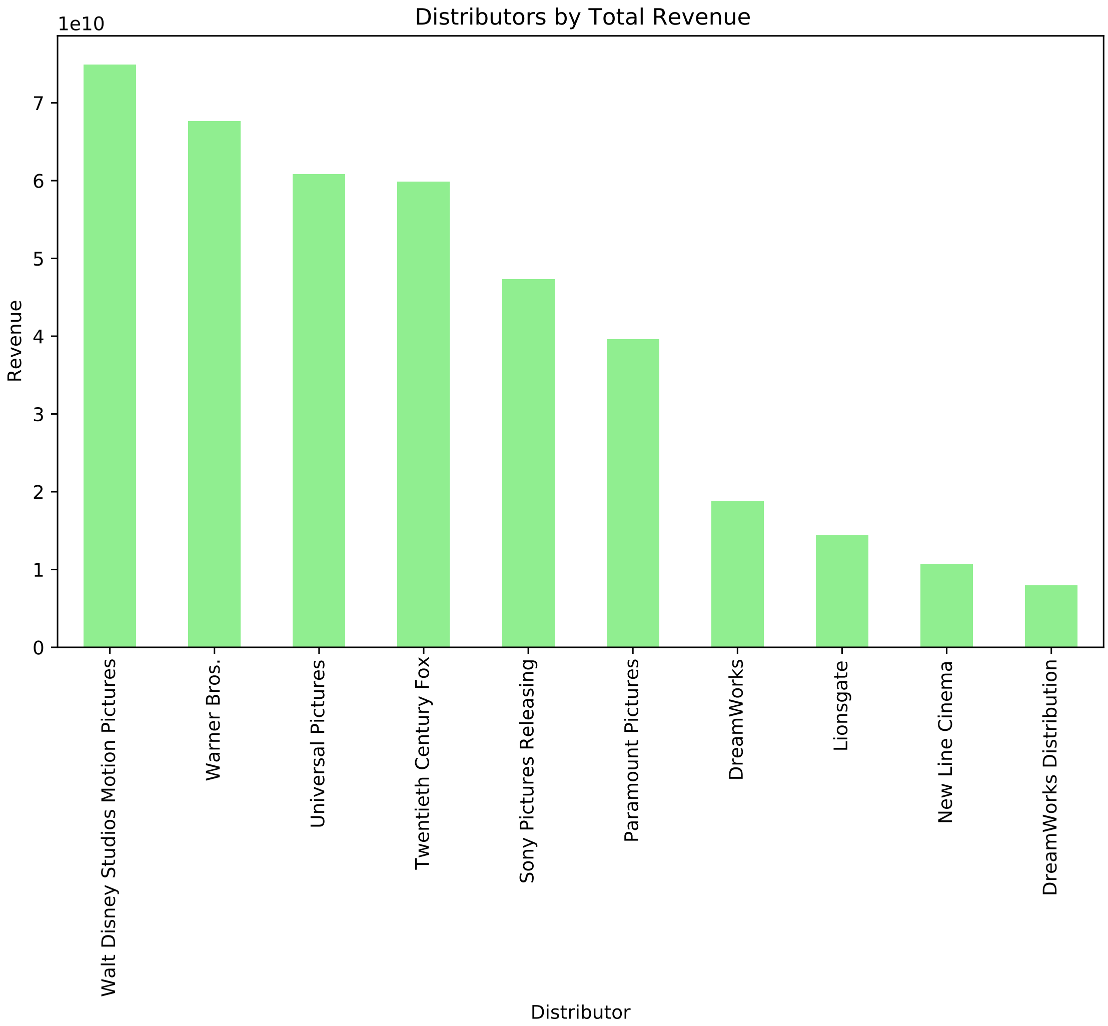
```
                                     num_of_movies   avg_revenue  total_revenue
Warner Bros.                                   388  1.742665e+08   6.761542e+10
Universal Pictures                             334  1.821510e+08   6.083843e+10
Twentieth Century Fox                          294  2.036574e+08   5.987527e+10
Sony Pictures Releasing                        263  1.799457e+08   4.732572e+10
Walt Disney Studios Motion Pictures            253  2.959322e+08   7.487085e+10
Paramount Pictures                             251  1.578226e+08   3.961348e+10
Lionsgate                                      142  1.005945e+08   1.438501e+10
New Line Cinema                                101  1.057787e+08   1.068365e+10
Miramax                                         98  5.373466e+07   5.265997e+09
Screen Gems                                     70  6.822087e+07   4.775461e+09
```

[321]:

```
# Distributors by Total Revenue

dist_df.sort_values(by=["total_revenue"], ascending=False).total_revenue.
 ↪head(10).plot.bar(color='lightgreen', figsize=(10,6))
plt.title("Distributors by Total Revenue")
plt.ylabel("Revenue")
plt.xlabel("Distributor")

#'Walt Disney Studios' has the highest total revenue earner
```

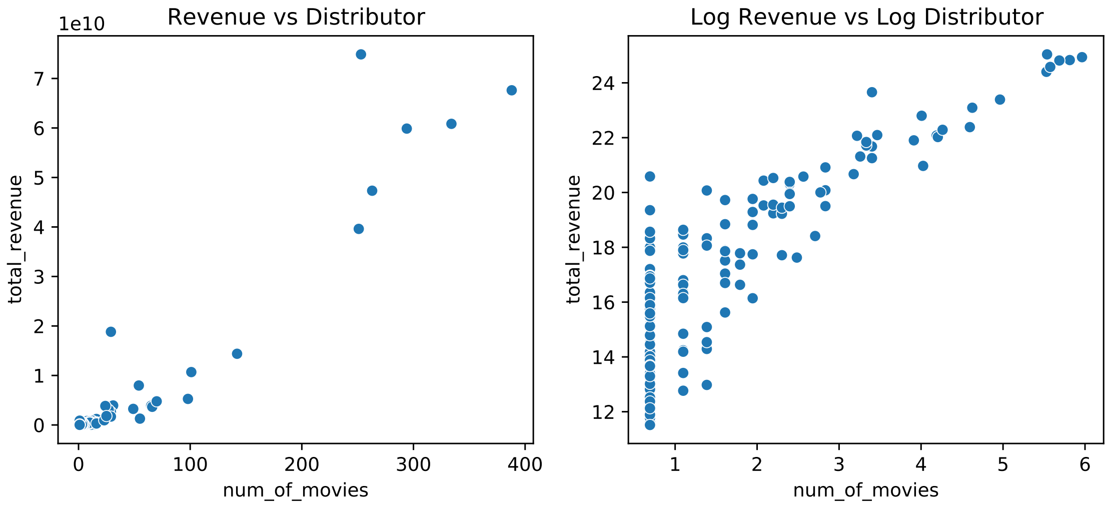
[321]:

```
Text(0.5, 0, 'Distributor')
```



[322]:

```
#Let us check at the relationship between Revenue and Distributor

plt.figure(figsize=(10,4))
plt.subplot(1,2,1)
sns.scatterplot(dist_df['num_of_movies'], dist_df['total_revenue'])
plt.title('Revenue vs Distributor');

#I will aslo check at the relationship using the log transformation to make the data look more normal
plt.subplot(1,2,2)
sns.scatterplot(np.log1p(dist_df['num_of_movies']), np.log1p(dist_df['total_revenue']))
plt.title('Log Revenue vs Log Distributor');
```



[323]:

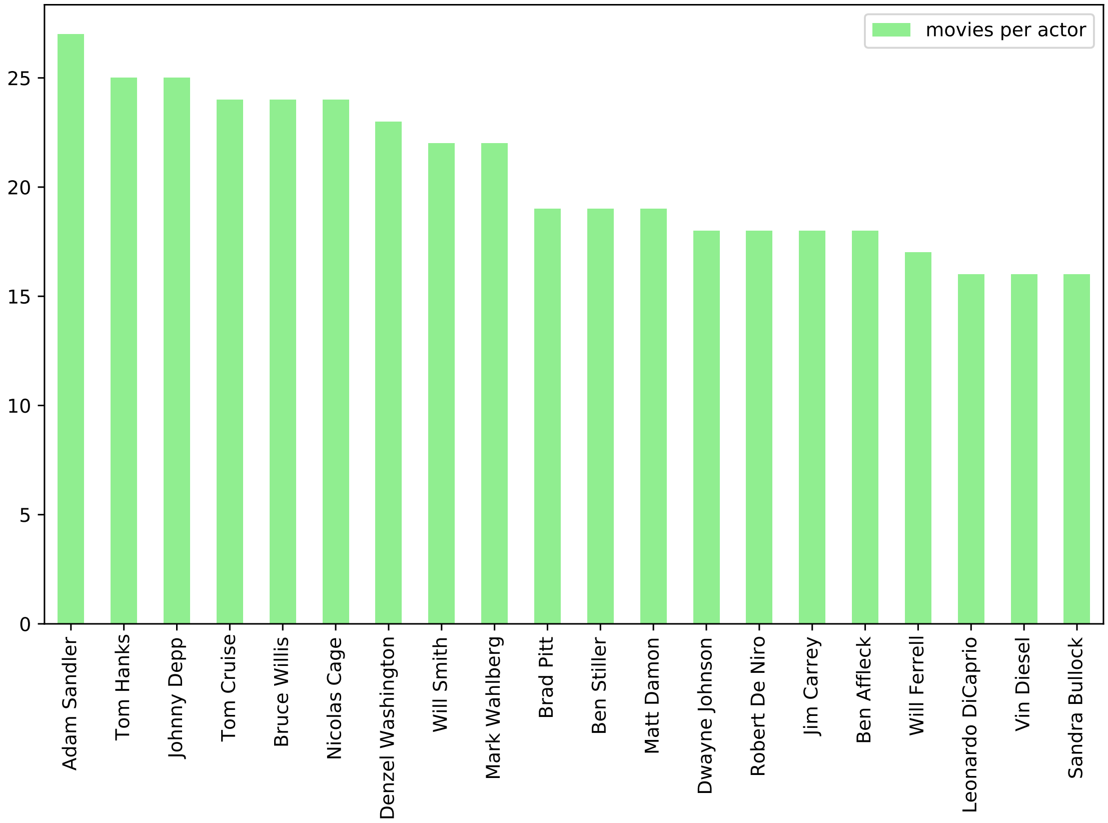
```
# Analysis of correlation
from scipy.stats import pearsonr

corr, _ = pearsonr(dist_df['num_of_movies'], dist_df['total_revenue'])
print('Pearsons correlation between Distributor and Worldwide Revenue: %.2f' %␣
 ↪corr)

corr, _ = pearsonr(np.log1p(dist_df['num_of_movies']), np.
 ↪log1p(dist_df['total_revenue']))
print('Pearsons correlation between log transformed distributor and log␣
 ↪transformed revenue: %.2f' % corr)

#There is a strong positive correlation between Distributor and Worldwide␣
 ↪Revenue
```

```
Pearsons correlation between Distributor and Worldwide Revenue: 0.96
Pearsons correlation between log transformed distributor and log transformed
revenue: 0.86
```

[324]:

```
# Main Actor

actorDict = {}
for elem in moviesNew["main_actor_1"].values:
    #for dist in element:
    if elem not in actorDict:
      actorDict[elem] = 1
    else:
      actorDict[elem] += 1
```

```
actor_df = pd.DataFrame.from_dict(actorDict, orient='index', columns=["movies␣
 ↪per actor"])
actor_df.sort_values(by="movies per actor", ascending=False).head(20).plot.
 ↪bar(color='lightgreen', figsize=(10,6))

actor_df.columns = ["num_of_movies"]

# The most popular actor based on the number of titles is Adam Sandler
```



[325]:

```
# Analysis of Worlwide Revenue with Main Actor

# Creating an index for Actors
actor_df.index.values
for d in actor_df.index.values:
    moviesNew[d] = moviesNew['main_actor_1'].apply(lambda x: 1 if d in x else 0)

# Average revenue per Actor
for i, d in enumerate(actor_df.index.values):
    actor_df.loc[d, "avg_revenue"] = moviesNew[moviesNew[d]==1].
 ↪Worldwide_Revenue.mean()
```

```
actor_df.sort_values(by=["num_of_movies", "avg_revenue"], ascending=False).
 ↪head(10)

# Total revenue per Actor
for i, d in enumerate(actor_df.index.values):
    actor_df.loc[d, "total_revenue"] = moviesNew[moviesNew[d]==1].
 ↪Worldwide_Revenue.sum()

actor_df.sort_values(by=["num_of_movies", "total_revenue"], ascending=False).
 ↪head(10)
```

[325]:

```
                   num_of_movies   avg_revenue  total_revenue
Adam Sandler                  27  1.833724e+08   4.951055e+09
Tom Hanks                     25  3.396758e+08   8.491896e+09
Johnny Depp                   25  2.907546e+08   7.268864e+09
Tom Cruise                    24  3.385520e+08   8.125249e+09
Bruce Willis                  24  1.700206e+08   4.080496e+09
Nicolas Cage                  24  1.307998e+08   3.139196e+09
Denzel Washington             23  1.357650e+08   3.122595e+09
Will Smith                    22  3.606110e+08   7.933443e+09
Mark Wahlberg                 22  1.927839e+08   4.241246e+09
Ben Stiller                   19  2.343967e+08   4.453537e+09
```

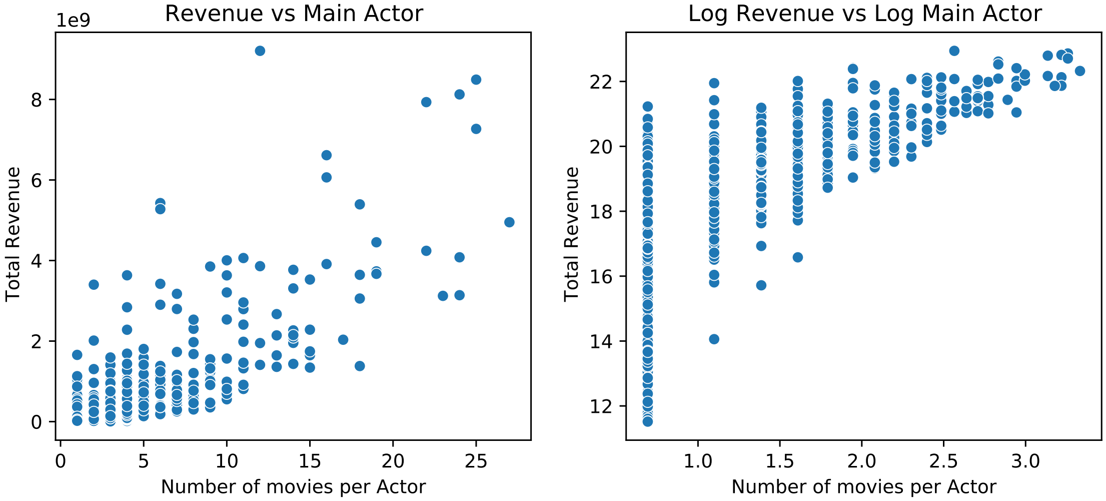
[326]:

```
# Checking the top 20 Main Actor by Total Revenue

top_20_actor = actor_df.sort_values(by=["total_revenue"], ascending=False).
 ↪head(20)
fig = px.bar(top_20_actor, x=top_20_actor.index, y='total_revenue', title =␣
 ↪'Top 20 Actors by Movies Revenue', color = 'total_revenue', height=600,␣
 ↪width=1000,
             labels={'Worldwide_Revenue':'Global Revenue in USD Billion', 'x':
 ↪''})
fig.show()

# The top Main Actor based on the total revenue earned is Robert Downey Jr.␣
 ↪with a total of $9,206,893,682
```

[327]:

```
#Let us check the relationship between Revenue and Main Actor

plt.figure(figsize=(10,4))
plt.subplot(1,2,1)
sns.scatterplot(actor_df['num_of_movies'], actor_df['total_revenue'])
plt.xlabel('Number of movies per Actor', size=10)
plt.ylabel('Total Revenue', size=10);
plt.title('Revenue vs Main Actor');

#I will aslo check at the relationship using the log transformation to make the␣
 ↪data look more normal
```

```
plt.subplot(1,2,2)
sns.scatterplot(np.log1p(actor_df['num_of_movies']), np.
 ↪log1p(actor_df['total_revenue']))
plt.xlabel('Number of movies per Actor', size=10)
plt.ylabel('Total Revenue', size=10);
plt.title('Log Revenue vs Log Main Actor');
```

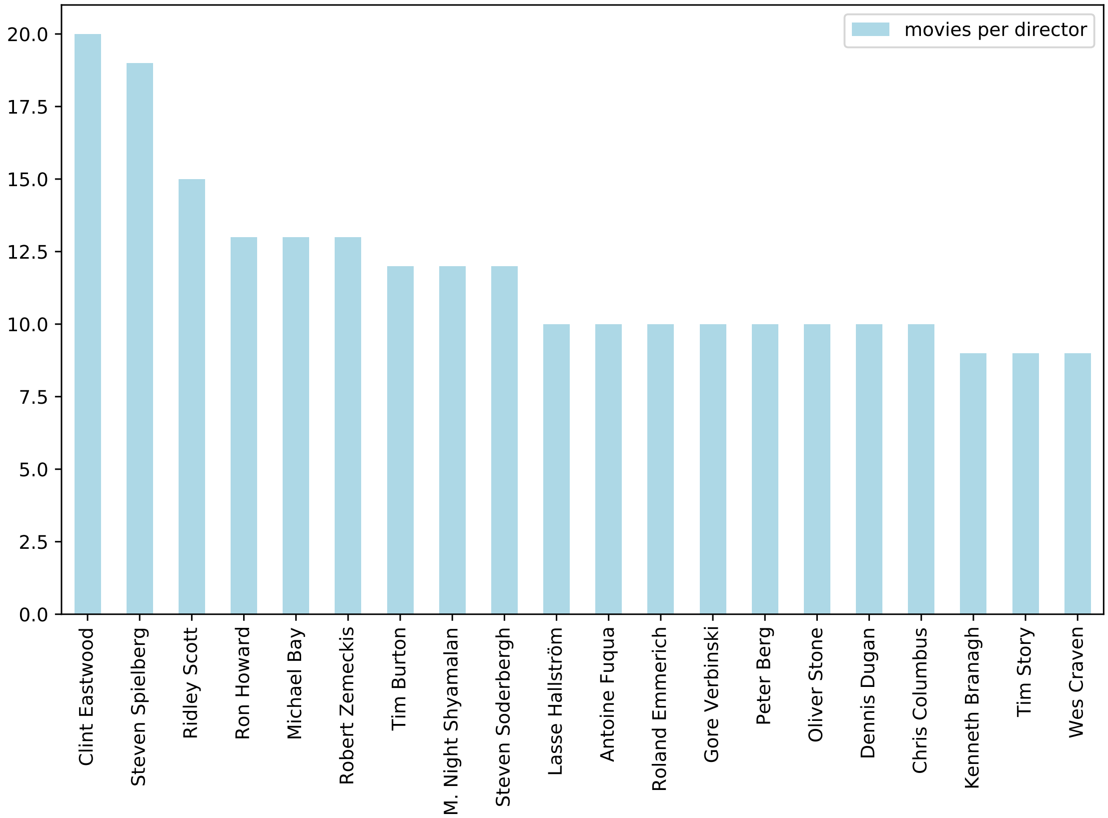


[328]:
```
#analysis of correlation and create log feature probably

corr, _ = pearsonr(actor_df['num_of_movies'], actor_df['total_revenue'])
print('Pearsons correlation between Main Actor and Worldwide Revenue: %.2f' %␣
 ↪corr)

corr, _ = pearsonr(np.log1p(actor_df['num_of_movies']), np.
 ↪log1p(actor_df['total_revenue']))
print('Pearsons correlation between log transformed Main Actor and log␣
 ↪transformed revenue: %.2f' % corr)

# There is a strong correlation between Main Actor and Worldwide Revenue
```

```
Pearsons correlation between Main Actor and Worldwide Revenue: 0.81
Pearsons correlation between log transformed Main Actor and log transformed
revenue: 0.65
```

[329]:
```
# Director

directorDict = {}
for elem in moviesNew["director"].values:
    #for dist in element:
```

```
    if elem not in directorDict:
      directorDict[elem] = 1
    else:
      directorDict[elem] += 1

director_df = pd.DataFrame.from_dict(directorDict, orient='index',␣
 ↪columns=["movies per director"])
director_df.sort_values(by="movies per director", ascending=False).head(20).
 ↪plot.bar(color='lightblue', figsize=(10,6))

director_df.columns = ["num_of_movies"]

# The most popular director based on the number of titles is Clint Eastwood
```



[330]:

```
# Analysis of Worlwide Revenue with Director

# Creating an index for Directors
director_df.index.values
for d in director_df.index.values:
    moviesNew[d] = moviesNew['director'].apply(lambda x: 1 if d in x else 0)
```

```
# Average revenue per Director
for i, d in enumerate(director_df.index.values):
    director_df.loc[d, "avg_revenue"] = moviesNew[moviesNew[d]==1].
 ↪Worldwide_Revenue.mean()

director_df.sort_values(by=["num_of_movies", "avg_revenue"], ascending=False).
 ↪head(10)

# Total revenue per Director
for i, d in enumerate(director_df.index.values):
    director_df.loc[d, "total_revenue"] = moviesNew[moviesNew[d]==1].
 ↪Worldwide_Revenue.sum()

director_df.sort_values(by=["num_of_movies", "total_revenue"], ascending=False).
 ↪head(10)
```

[330]:

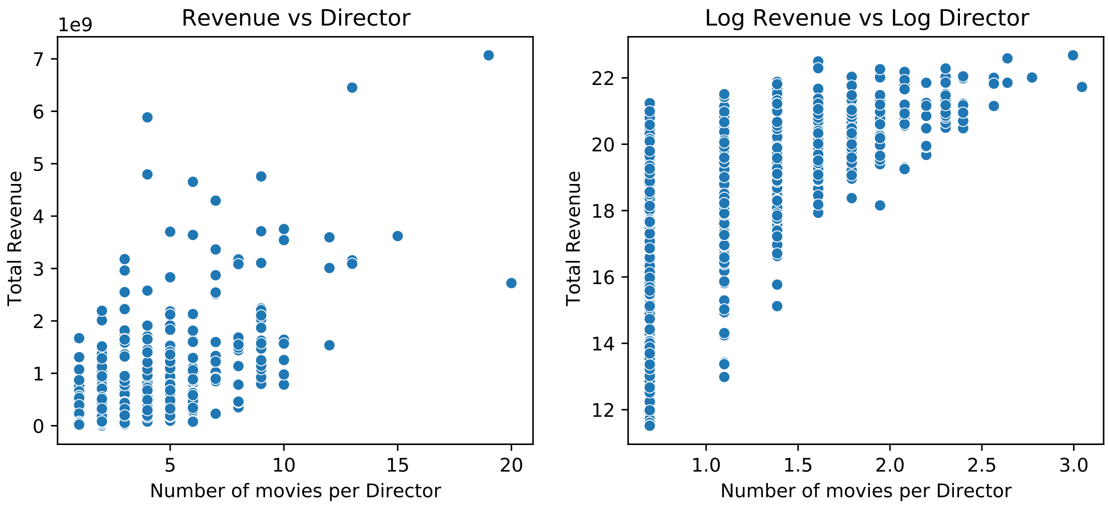
```
                    num_of_movies   avg_revenue  total_revenue
Clint Eastwood                 20  1.360770e+08   2.721540e+09
Steven Spielberg               19  3.719823e+08   7.067664e+09
Ridley Scott                   15  2.412803e+08   3.619204e+09
Michael Bay                    13  4.962841e+08   6.451693e+09
Robert Zemeckis                13  2.427907e+08   3.156279e+09
Ron Howard                     13  2.377258e+08   3.090435e+09
Tim Burton                     12  2.995747e+08   3.594897e+09
M. Night Shyamalan             12  2.507975e+08   3.009570e+09
Steven Soderbergh              12  1.279796e+08   1.535756e+09
Roland Emmerich                10  3.761203e+08   3.761203e+09
```

[331]:

```
# Checking the top 20 Director by Total Revenue

top_20_director = director_df.sort_values(by=["total_revenue"],␣
 ↪ascending=False).head(20)
fig = px.bar(top_20_director, x=top_20_director.index, y='total_revenue', title␣
 ↪= 'Top 20 Directors by Movies Revenue', color = 'total_revenue', height=600,␣
 ↪width=1000,
             labels={'Worldwide_Revenue':'Global Revenue in USD Billion', 'x':
 ↪''})
fig.show()

# The top Director based on the total revenue earned is Steven Spiellberg with␣
 ↪a total of $7,067,663,962
```

[332]:

```
#Let us check at the relationship between Revenue and Director

plt.figure(figsize=(10,4))
plt.subplot(1,2,1)
sns.scatterplot(director_df['num_of_movies'], director_df['total_revenue'])
plt.xlabel('Number of movies per Director', size=10)
plt.ylabel('Total Revenue', size=10);
plt.title('Revenue vs Director');

#I will aslo check at the relationship using the log transformation to make the␣
 ↪data look more normal
plt.subplot(1,2,2)
sns.scatterplot(np.log1p(director_df['num_of_movies']), np.
 ↪log1p(director_df['total_revenue']))
plt.xlabel('Number of movies per Director', size=10)
plt.ylabel('Total Revenue', size=10);
plt.title('Log Revenue vs Log Director');
```



[333]:

```
# Analysis of correlation

corr, _ = pearsonr(director_df['num_of_movies'], director_df['total_revenue'])
print('Pearsons correlation between Director and Worldwide Revenue: %.2f' %␣
 ↪corr)

corr, _ = pearsonr(np.log1p(director_df['num_of_movies']), np.
 ↪log1p(director_df['total_revenue']))
print('Pearsons correlation between log transformed Director and log␣
 ↪transformed revenue: %.2f' % corr)

#There is a strong positive correlation between Director and Worldwide Revenue
```

```
Pearsons correlation between Director and Worldwide Revenue: 0.73
Pearsons correlation between log transformed Director and log transformed
revenue: 0.66
```

[335]:

```
%%capture
!wget -nc https://raw.githubusercontent.com/brpy/colab-pdf/master/colab_pdf.py
from colab_pdf import colab_pdf
colab_pdf('BoxOffice_Rev_Prediction.ipynb')
```