

Investigate_a_Dataset

June 18, 2020

1 Project: Investigate a Dataset (TMDb Dataset)

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Introduction TMDb Movie data from Kaggle is chosen to investiage in the project. This data set contains information about 10,000 movies collected from The Movie Database (TMDb), including user ratings and revenue.

- Some columns, like cast and genres, contain multiple values separated by pipe (|) characters.
- The final two columns ending with _adj show the budget and revenue of the associated movie in terms of 2010 dollars, accounting for inflation over time.

1.2 Questions

Here are the questions need to answer:

- Which movies were most and least profitable?
- What was the most profitable movie each year?
- Do movie budgets increase over time?
- What is the most profitable genre?

1.3 Import Libraries

```
In [1]: import numpy as np
        import pandas as pd
        import seaborn as sns
        import matplotlib.pyplot as plt
        from scipy import stats
%matplotlib inline
```

```
In [2]: plt.style.use('fivethirtyeight')
        plt.style.use('seaborn-poster')
```

```

# Format floats to show commas and two decimals
pd.options.display.float_format = "{0:,.2f}".format

## Data Wrangling

In [3]: df = pd.read_csv('tmdb-movies.csv')
df.head()

Out[3]:      id    imdb_id  popularity     budget     revenue \
0   135397  tt0369610      32.99  150000000  1513528810
1    76341  tt1392190      28.42  150000000   378436354
2   262500  tt2908446      13.11  110000000   295238201
3   140607  tt2488496      11.17  200000000  2068178225
4   168259  tt2820852       9.34  190000000  1506249360

                     original_title \
0                  Jurassic World
1          Mad Max: Fury Road
2            Insurgent
3  Star Wars: The Force Awakens
4           Furious 7

                     cast \
0  Chris Pratt|Bryce Dallas Howard|Irrfan Khan|Vi...
1  Tom Hardy|Charlize Theron|Hugh Keays-Byrne|Nic...
2  Shailene Woodley|Theo James|Kate Winslet|Ansel...
3  Harrison Ford|Mark Hamill|Carrie Fisher|Adam D...
4  Vin Diesel|Paul Walker|Jason Statham|Michelle ...

                     homepage        director \
0  http://www.jurassicworld.com/ Colin Trevorrow
1  http://www.madmaxmovie.com/  George Miller
2  http://www.thedivergentseries.movie/#insurgent Robert Schwentke
3  http://www.starwars.com/films/star-wars-episod... J.J. Abrams
4  http://www.furious7.com/      James Wan

                     tagline ...
0      The park is open. ...
1      What a Lovely Day. ...
2  One Choice Can Destroy You ...
3  Every generation has a story. ...
4      Vengeance Hits Home ...

                     overview runtime \
0  Twenty-two years after the events of Jurassic ...     124
1  An apocalyptic story set in the furthest reach...     120
2  Beatrice Prior must confront her inner demons ...     119
3  Thirty years after defeating the Galactic Empi...     136

```

```
4 Deckard Shaw seeks revenge against Dominic Tor... 137
```

```
          genres \
0 Action|Adventure|Science Fiction|Thriller
1 Action|Adventure|Science Fiction|Thriller
2           Adventure|Science Fiction|Thriller
3 Action|Adventure|Science Fiction|Fantasy
4                   Action|Crime|Thriller

                     production_companies release_date vote_count \
0 Universal Studios|Amblin Entertainment|Legenda... 6/9/15      5562
1 Village Roadshow Pictures|Kennedy Miller Produ... 5/13/15      6185
2 Summit Entertainment|Mandeville Films|Red Wago... 3/18/15      2480
3 Lucasfilm|Truenorth Productions|Bad Robot    12/15/15     5292
4 Universal Pictures|Original Film|Media Rights ... 4/1/15      2947

      vote_average   release_year      budget_adj      revenue_adj
0         6.50        2015 137,999,939.28 1,392,445,892.52
1         7.10        2015 137,999,939.28  348,161,292.49
2         6.30        2015 101,199,955.47  271,619,025.41
3         7.50        2015 183,999,919.04 1,902,723,129.80
4         7.30        2015 174,799,923.09  1,385,748,801.47
```

[5 rows x 21 columns]

```
In [4]: df.shape
```

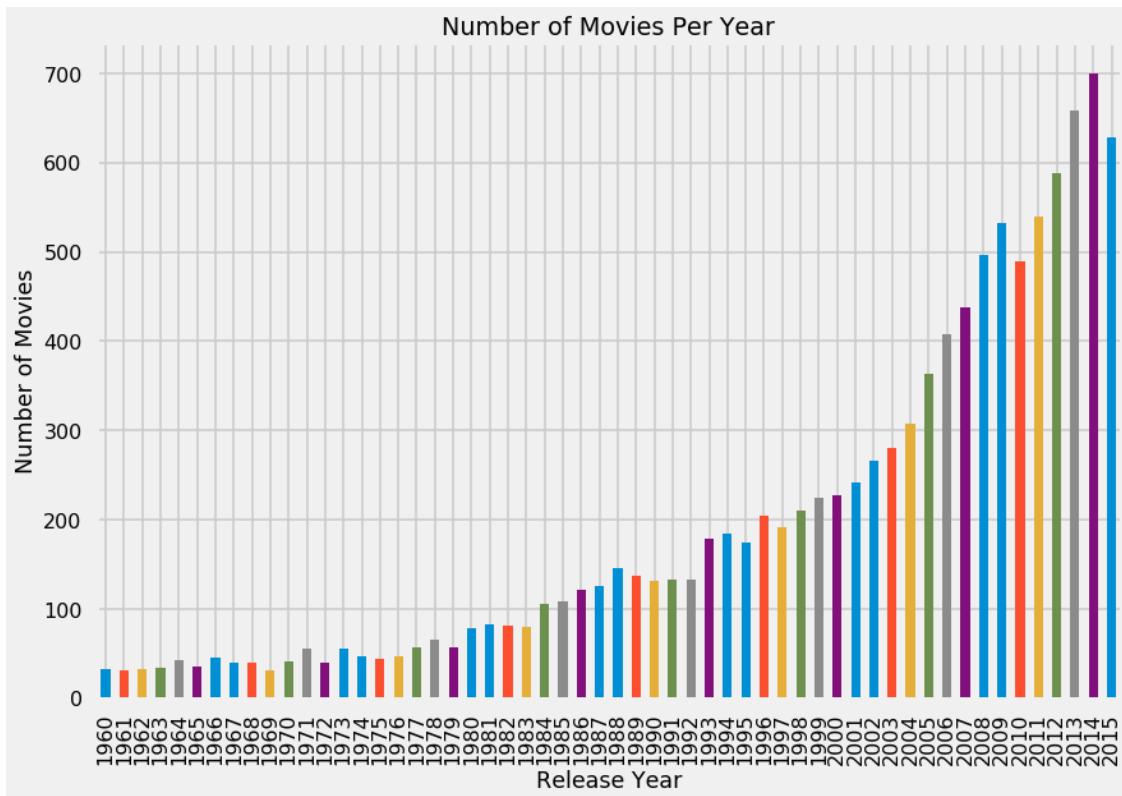
```
Out[4]: (10866, 21)
```

```
In [5]: df.dtypes
```

```
Out[5]: id                  int64
imdb_id              object
popularity            float64
budget                int64
revenue               int64
original_title        object
cast                 object
homepage              object
director              object
tagline               object
keywords              object
overview              object
runtime                int64
genres                object
production_companies object
release_date           object
vote_count             int64
vote_average           float64
```

```
release_year           int64
budget_adj             float64
revenue_adj            float64
dtype: object
```

```
In [6]: #How many movies released by years?
df.groupby('release_year')['id'].count().plot.bar()
plt.xlabel('Release Year')
plt.ylabel('Number of Movies')
plt.title('Number of Movies Per Year')
plt.show()
```



Data Cleaning

Eliminate duplicates

```
In [7]: sum(df.duplicated())
```

```
Out[7]: 1
```

```
In [8]: df.drop_duplicates(inplace=True)
```

Convert datatypes

```
In [9]: df.dtypes.release_date
```

```
Out[9]: dtype('O')
```

```
In [10]: # Convert to a datetime
df['release_date'] = pd.to_datetime(df['release_date'])
```

```
In [11]: # Double check
df.dtypes.release_date
```

```
Out[11]: dtype('<M8[ns]')
```

Add columns

```
In [12]: # Calculate net income only if both budget_adj and revenue_adj are > 0
def income(row):
    if row['budget_adj'] > 0 and row['revenue_adj'] > 0:
        val = row['revenue_adj'] - row['budget_adj']
    else:
        val = float('NaN')
    return val
```

```
In [13]: # Add a net_income column
df['net_income'] = df.apply(income, axis=1)
df.head()
```

```
Out[13]:      id   imdb_id  popularity     budget     revenue \
0  135397  tt0369610      32.99  150000000  1513528810
1   76341  tt1392190      28.42  150000000   378436354
2  262500  tt2908446      13.11  110000000   295238201
3  140607  tt2488496      11.17  200000000   2068178225
4  168259  tt2820852       9.34  190000000   1506249360

                           original_title \
0                  Jurassic World
1          Mad Max: Fury Road
2                Insurgent
3  Star Wars: The Force Awakens
4                 Furious 7

                           cast \
0  Chris Pratt|Bryce Dallas Howard|Irrfan Khan|Vi...
1  Tom Hardy|Charlize Theron|Hugh Keays-Byrne|Nic...
2  Shailene Woodley|Theo James|Kate Winslet|Ansel...
3  Harrison Ford|Mark Hamill|Carrie Fisher|Adam D...
4  Vin Diesel|Paul Walker|Jason Statham|Michelle ...
```

```

                    homepage      director \
0          http://www.jurassicworld.com/ Colin Trevorrow
1          http://www.madmaxmovie.com/ George Miller
2 http://www.thedivergentseries.movie/#insurgent Robert Schwentke
3 http://www.starwars.com/films/star-wars-episod... J.J. Abrams
4          http://www.furious7.com/ James Wan

                tagline      ... runtime \
0        The park is open.     ...    124
1        What a Lovely Day.   ...    120
2 One Choice Can Destroy You   ...    119
3 Every generation has a story.   ...    136
4        Vengeance Hits Home   ...    137

            genres \
0 Action|Adventure|Science Fiction|Thriller
1 Action|Adventure|Science Fiction|Thriller
2           Adventure|Science Fiction|Thriller
3 Action|Adventure|Science Fiction|Fantasy
4           Action|Crime|Thriller

            production_companies release_date vote_count \
0 Universal Studios|Amblin Entertainment|Legenda... 2015-06-09      5562
1 Village Roadshow Pictures|Kennedy Miller Produ... 2015-05-13      6185
2 Summit Entertainment|Mandeville Films|Red Wago... 2015-03-18      2480
3 Lucasfilm|Truenorth Productions|Bad Robot 2015-12-15      5292
4 Universal Pictures|Original Film|Media Rights ... 2015-04-01      2947

      vote_average  release_year      budget_adj      revenue_adj      net_income
0         6.50      2015 137,999,939.28 1,392,445,892.52 1,254,445,953.24
1         7.10      2015 137,999,939.28  348,161,292.49  210,161,353.21
2         6.30      2015 101,199,955.47  271,619,025.41  170,419,069.94
3         7.50      2015 183,999,919.04 1,902,723,129.80 1,718,723,210.76
4         7.30      2015 174,799,923.09 1,385,748,801.47  1,210,948,878.38

```

[5 rows x 22 columns]

In [14]: df.net_income.describe()

Out[14]:

count	3,854.00
mean	92,824,697.22
std	194,071,459.74
min	-413,912,431.00
25%	-1,504,994.63
50%	27,370,641.16
75%	107,454,751.41
max	2,750,136,650.92
Name:	net_income, dtype: float64

Normalize overloaded columns The cast and genres columns are pipe-delimited strings. I am going to extract them into new dataframes and create lookup dataframes to handle the relationships.

```
In [15]: def splitDataFrameList(df, target_column, separator):
    row_accumulator = []

    def splitListToRows(row, separator):
        split_row = row[target_column].split(separator)
        for s in split_row:
            new_row = row.to_dict()
            new_row[target_column] = s
            row_accumulator.append(new_row)

    df.apply(splitListToRows, axis=1, args=(separator, ))
    new_df = pd.DataFrame(row_accumulator)
    return new_df
```

```
In [16]: # Split and flatten the cast and genres categories
df_flat = splitDataFrameList(df.dropna(), 'cast', '|')
df_flat = splitDataFrameList(df_flat.dropna(), 'genres', '|')
df_flat = splitDataFrameList(df_flat.dropna(), 'keywords', '|')
```

```
In [17]: df_flat.describe()
```

```
Out[17]:
```

	budget	budget_adj	id	net_income	popularity	\
count	79,400.00	79,400.00	79,400.00	79,400.00	79,400.00	
mean	60,724,919.60	63,757,724.78	49,444.64	172,223,733.42	2.03	
std	59,801,738.44	59,404,434.38	70,693.56	295,085,244.58	2.46	
min	1.00	0.97	11.00	-413,912,431.00	0.01	
25%	17,000,000.00	19,387,960.85	4,464.00	5,387,689.10	0.76	
50%	40,000,000.00	43,622,911.92	17,979.00	60,073,390.00	1.32	
75%	85,000,000.00	91,941,878.45	60,308.00	210,161,353.21	2.49	
max	425,000,000.00	425,000,000.00	333,348.00	2,750,136,650.92	32.99	

	release_year	revenue	revenue_adj	runtime	vote_average	\
count	79,400.00	79,400.00	79,400.00	79,400.00	79,400.00	
mean	2,006.67	208,570,350.20	235,981,458.19	111.02	6.30	
std	8.49	281,825,273.88	326,061,177.81	19.43	0.80	
min	1,961.00	43.00	43.00	63.00	2.20	
25%	2,005.00	31,670,620.00	34,084,779.31	97.00	5.80	
50%	2,009.00	101,371,017.00	110,662,825.91	108.00	6.30	
75%	2,011.00	284,600,000.00	320,834,306.77	122.00	6.90	
max	2,015.00	2,781,505,847.00	2,827,123,750.41	201.00	8.30	

	vote_count
count	79,400.00
mean	1,110.75
std	1,377.22

```

min           10.00
25%          228.00
50%          560.00
75%         1,527.00
max         9,767.00

```

In [18]: df_flat.head(50)

	budget	budget_adj	cast	director
0	150000000	137,999,939.28	Chris Pratt	Colin Trevorrow
1	150000000	137,999,939.28	Chris Pratt	Colin Trevorrow
2	150000000	137,999,939.28	Chris Pratt	Colin Trevorrow
3	150000000	137,999,939.28	Chris Pratt	Colin Trevorrow
4	150000000	137,999,939.28	Chris Pratt	Colin Trevorrow
5	150000000	137,999,939.28	Chris Pratt	Colin Trevorrow
6	150000000	137,999,939.28	Chris Pratt	Colin Trevorrow
7	150000000	137,999,939.28	Chris Pratt	Colin Trevorrow
8	150000000	137,999,939.28	Chris Pratt	Colin Trevorrow
9	150000000	137,999,939.28	Chris Pratt	Colin Trevorrow
10	150000000	137,999,939.28	Chris Pratt	Colin Trevorrow
11	150000000	137,999,939.28	Chris Pratt	Colin Trevorrow
12	150000000	137,999,939.28	Chris Pratt	Colin Trevorrow
13	150000000	137,999,939.28	Chris Pratt	Colin Trevorrow
14	150000000	137,999,939.28	Chris Pratt	Colin Trevorrow
15	150000000	137,999,939.28	Chris Pratt	Colin Trevorrow
16	150000000	137,999,939.28	Chris Pratt	Colin Trevorrow
17	150000000	137,999,939.28	Chris Pratt	Colin Trevorrow
18	150000000	137,999,939.28	Chris Pratt	Colin Trevorrow
19	150000000	137,999,939.28	Chris Pratt	Colin Trevorrow
20	150000000	137,999,939.28	Bryce Dallas Howard	Colin Trevorrow
21	150000000	137,999,939.28	Bryce Dallas Howard	Colin Trevorrow
22	150000000	137,999,939.28	Bryce Dallas Howard	Colin Trevorrow
23	150000000	137,999,939.28	Bryce Dallas Howard	Colin Trevorrow
24	150000000	137,999,939.28	Bryce Dallas Howard	Colin Trevorrow
25	150000000	137,999,939.28	Bryce Dallas Howard	Colin Trevorrow
26	150000000	137,999,939.28	Bryce Dallas Howard	Colin Trevorrow
27	150000000	137,999,939.28	Bryce Dallas Howard	Colin Trevorrow
28	150000000	137,999,939.28	Bryce Dallas Howard	Colin Trevorrow
29	150000000	137,999,939.28	Bryce Dallas Howard	Colin Trevorrow
30	150000000	137,999,939.28	Bryce Dallas Howard	Colin Trevorrow
31	150000000	137,999,939.28	Bryce Dallas Howard	Colin Trevorrow
32	150000000	137,999,939.28	Bryce Dallas Howard	Colin Trevorrow
33	150000000	137,999,939.28	Bryce Dallas Howard	Colin Trevorrow
34	150000000	137,999,939.28	Bryce Dallas Howard	Colin Trevorrow
35	150000000	137,999,939.28	Bryce Dallas Howard	Colin Trevorrow
36	150000000	137,999,939.28	Bryce Dallas Howard	Colin Trevorrow
37	150000000	137,999,939.28	Bryce Dallas Howard	Colin Trevorrow
38	150000000	137,999,939.28	Bryce Dallas Howard	Colin Trevorrow

39	150000000	137,999,939.28	Bryce Dallas Howard	Colin Trevorrow	
40	150000000	137,999,939.28	Irrfan Khan	Colin Trevorrow	
41	150000000	137,999,939.28	Irrfan Khan	Colin Trevorrow	
42	150000000	137,999,939.28	Irrfan Khan	Colin Trevorrow	
43	150000000	137,999,939.28	Irrfan Khan	Colin Trevorrow	
44	150000000	137,999,939.28	Irrfan Khan	Colin Trevorrow	
45	150000000	137,999,939.28	Irrfan Khan	Colin Trevorrow	
46	150000000	137,999,939.28	Irrfan Khan	Colin Trevorrow	
47	150000000	137,999,939.28	Irrfan Khan	Colin Trevorrow	
48	150000000	137,999,939.28	Irrfan Khan	Colin Trevorrow	
49	150000000	137,999,939.28	Irrfan Khan	Colin Trevorrow	
0	genres	homepage	id	imdb_id	\
1	Action	http://www.jurassicworld.com/	135397	tt0369610	
2	Action	http://www.jurassicworld.com/	135397	tt0369610	
3	Action	http://www.jurassicworld.com/	135397	tt0369610	
4	Action	http://www.jurassicworld.com/	135397	tt0369610	
5	Adventure	http://www.jurassicworld.com/	135397	tt0369610	
6	Adventure	http://www.jurassicworld.com/	135397	tt0369610	
7	Adventure	http://www.jurassicworld.com/	135397	tt0369610	
8	Adventure	http://www.jurassicworld.com/	135397	tt0369610	
9	Adventure	http://www.jurassicworld.com/	135397	tt0369610	
10	Science Fiction	http://www.jurassicworld.com/	135397	tt0369610	
11	Science Fiction	http://www.jurassicworld.com/	135397	tt0369610	
12	Science Fiction	http://www.jurassicworld.com/	135397	tt0369610	
13	Science Fiction	http://www.jurassicworld.com/	135397	tt0369610	
14	Science Fiction	http://www.jurassicworld.com/	135397	tt0369610	
15	Thriller	http://www.jurassicworld.com/	135397	tt0369610	
16	Thriller	http://www.jurassicworld.com/	135397	tt0369610	
17	Thriller	http://www.jurassicworld.com/	135397	tt0369610	
18	Thriller	http://www.jurassicworld.com/	135397	tt0369610	
19	Thriller	http://www.jurassicworld.com/	135397	tt0369610	
20	Action	http://www.jurassicworld.com/	135397	tt0369610	
21	Action	http://www.jurassicworld.com/	135397	tt0369610	
22	Action	http://www.jurassicworld.com/	135397	tt0369610	
23	Action	http://www.jurassicworld.com/	135397	tt0369610	
24	Action	http://www.jurassicworld.com/	135397	tt0369610	
25	Adventure	http://www.jurassicworld.com/	135397	tt0369610	
26	Adventure	http://www.jurassicworld.com/	135397	tt0369610	
27	Adventure	http://www.jurassicworld.com/	135397	tt0369610	
28	Adventure	http://www.jurassicworld.com/	135397	tt0369610	
29	Adventure	http://www.jurassicworld.com/	135397	tt0369610	
30	Science Fiction	http://www.jurassicworld.com/	135397	tt0369610	
31	Science Fiction	http://www.jurassicworld.com/	135397	tt0369610	
32	Science Fiction	http://www.jurassicworld.com/	135397	tt0369610	
33	Science Fiction	http://www.jurassicworld.com/	135397	tt0369610	
34	Science Fiction	http://www.jurassicworld.com/	135397	tt0369610	

```

35      Thriller http://www.jurassicworld.com/ 135397 tt0369610
36      Thriller http://www.jurassicworld.com/ 135397 tt0369610
37      Thriller http://www.jurassicworld.com/ 135397 tt0369610
38      Thriller http://www.jurassicworld.com/ 135397 tt0369610
39      Thriller http://www.jurassicworld.com/ 135397 tt0369610
40          Action http://www.jurassicworld.com/ 135397 tt0369610
41          Action http://www.jurassicworld.com/ 135397 tt0369610
42          Action http://www.jurassicworld.com/ 135397 tt0369610
43          Action http://www.jurassicworld.com/ 135397 tt0369610
44          Action http://www.jurassicworld.com/ 135397 tt0369610
45      Adventure http://www.jurassicworld.com/ 135397 tt0369610
46      Adventure http://www.jurassicworld.com/ 135397 tt0369610
47      Adventure http://www.jurassicworld.com/ 135397 tt0369610
48      Adventure http://www.jurassicworld.com/ 135397 tt0369610
49      Adventure http://www.jurassicworld.com/ 135397 tt0369610

```

	keywords	net_income	...	popularity \
0	monster	1,254,445,953.24	...	32.99
1	dna	1,254,445,953.24	...	32.99
2	tyrannosaurus rex	1,254,445,953.24	...	32.99
3	velociraptor	1,254,445,953.24	...	32.99
4	island	1,254,445,953.24	...	32.99
5	monster	1,254,445,953.24	...	32.99
6	dna	1,254,445,953.24	...	32.99
7	tyrannosaurus rex	1,254,445,953.24	...	32.99
8	velociraptor	1,254,445,953.24	...	32.99
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10	monster	1,254,445,953.24	...	32.99
11	dna	1,254,445,953.24	...	32.99
12	tyrannosaurus rex	1,254,445,953.24	...	32.99
13	velociraptor	1,254,445,953.24	...	32.99
14	island	1,254,445,953.24	...	32.99
15	monster	1,254,445,953.24	...	32.99
16	dna	1,254,445,953.24	...	32.99
17	tyrannosaurus rex	1,254,445,953.24	...	32.99
18	velociraptor	1,254,445,953.24	...	32.99
19	island	1,254,445,953.24	...	32.99
20	monster	1,254,445,953.24	...	32.99
21	dna	1,254,445,953.24	...	32.99
22	tyrannosaurus rex	1,254,445,953.24	...	32.99
23	velociraptor	1,254,445,953.24	...	32.99
24	island	1,254,445,953.24	...	32.99
25	monster	1,254,445,953.24	...	32.99
26	dna	1,254,445,953.24	...	32.99
27	tyrannosaurus rex	1,254,445,953.24	...	32.99
28	velociraptor	1,254,445,953.24	...	32.99
29	island	1,254,445,953.24	...	32.99
30	monster	1,254,445,953.24	...	32.99

31		dna	1,254,445,953.24	...	32.99
32	tyrannosaurus rex	1,254,445,953.24	...	32.99	
33	velociraptor	1,254,445,953.24	...	32.99	
34	island	1,254,445,953.24	...	32.99	
35	monster	1,254,445,953.24	...	32.99	
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38	velociraptor	1,254,445,953.24	...	32.99	
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43	velociraptor	1,254,445,953.24	...	32.99	
44	island	1,254,445,953.24	...	32.99	
45	monster	1,254,445,953.24	...	32.99	
46	dna	1,254,445,953.24	...	32.99	
47	tyrannosaurus rex	1,254,445,953.24	...	32.99	
48	velociraptor	1,254,445,953.24	...	32.99	
49	island	1,254,445,953.24	...	32.99	

		production_companies	release_date	\
0	Universal Studios Amblin Entertainment Legenda...		2015-06-09	
1	Universal Studios Amblin Entertainment Legenda...		2015-06-09	
2	Universal Studios Amblin Entertainment Legenda...		2015-06-09	
3	Universal Studios Amblin Entertainment Legenda...		2015-06-09	
4	Universal Studios Amblin Entertainment Legenda...		2015-06-09	
5	Universal Studios Amblin Entertainment Legenda...		2015-06-09	
6	Universal Studios Amblin Entertainment Legenda...		2015-06-09	
7	Universal Studios Amblin Entertainment Legenda...		2015-06-09	
8	Universal Studios Amblin Entertainment Legenda...		2015-06-09	
9	Universal Studios Amblin Entertainment Legenda...		2015-06-09	
10	Universal Studios Amblin Entertainment Legenda...		2015-06-09	
11	Universal Studios Amblin Entertainment Legenda...		2015-06-09	
12	Universal Studios Amblin Entertainment Legenda...		2015-06-09	
13	Universal Studios Amblin Entertainment Legenda...		2015-06-09	
14	Universal Studios Amblin Entertainment Legenda...		2015-06-09	
15	Universal Studios Amblin Entertainment Legenda...		2015-06-09	
16	Universal Studios Amblin Entertainment Legenda...		2015-06-09	
17	Universal Studios Amblin Entertainment Legenda...		2015-06-09	
18	Universal Studios Amblin Entertainment Legenda...		2015-06-09	
19	Universal Studios Amblin Entertainment Legenda...		2015-06-09	
20	Universal Studios Amblin Entertainment Legenda...		2015-06-09	
21	Universal Studios Amblin Entertainment Legenda...		2015-06-09	
22	Universal Studios Amblin Entertainment Legenda...		2015-06-09	
23	Universal Studios Amblin Entertainment Legenda...		2015-06-09	
24	Universal Studios Amblin Entertainment Legenda...		2015-06-09	
25	Universal Studios Amblin Entertainment Legenda...		2015-06-09	
26	Universal Studios Amblin Entertainment Legenda...		2015-06-09	

27	Universal Studios Amblin Entertainment Legenda...			2015-06-09
28	Universal Studios Amblin Entertainment Legenda...			2015-06-09
29	Universal Studios Amblin Entertainment Legenda...			2015-06-09
30	Universal Studios Amblin Entertainment Legenda...			2015-06-09
31	Universal Studios Amblin Entertainment Legenda...			2015-06-09
32	Universal Studios Amblin Entertainment Legenda...			2015-06-09
33	Universal Studios Amblin Entertainment Legenda...			2015-06-09
34	Universal Studios Amblin Entertainment Legenda...			2015-06-09
35	Universal Studios Amblin Entertainment Legenda...			2015-06-09
36	Universal Studios Amblin Entertainment Legenda...			2015-06-09
37	Universal Studios Amblin Entertainment Legenda...			2015-06-09
38	Universal Studios Amblin Entertainment Legenda...			2015-06-09
39	Universal Studios Amblin Entertainment Legenda...			2015-06-09
40	Universal Studios Amblin Entertainment Legenda...			2015-06-09
41	Universal Studios Amblin Entertainment Legenda...			2015-06-09
42	Universal Studios Amblin Entertainment Legenda...			2015-06-09
43	Universal Studios Amblin Entertainment Legenda...			2015-06-09
44	Universal Studios Amblin Entertainment Legenda...			2015-06-09
45	Universal Studios Amblin Entertainment Legenda...			2015-06-09
46	Universal Studios Amblin Entertainment Legenda...			2015-06-09
47	Universal Studios Amblin Entertainment Legenda...			2015-06-09
48	Universal Studios Amblin Entertainment Legenda...			2015-06-09
49	Universal Studios Amblin Entertainment Legenda...			2015-06-09

	release_year	revenue	revenue_adj	runtime	tagline \
0	2015	1513528810	1,392,445,892.52	124	The park is open.
1	2015	1513528810	1,392,445,892.52	124	The park is open.
2	2015	1513528810	1,392,445,892.52	124	The park is open.
3	2015	1513528810	1,392,445,892.52	124	The park is open.
4	2015	1513528810	1,392,445,892.52	124	The park is open.
5	2015	1513528810	1,392,445,892.52	124	The park is open.
6	2015	1513528810	1,392,445,892.52	124	The park is open.
7	2015	1513528810	1,392,445,892.52	124	The park is open.
8	2015	1513528810	1,392,445,892.52	124	The park is open.
9	2015	1513528810	1,392,445,892.52	124	The park is open.
10	2015	1513528810	1,392,445,892.52	124	The park is open.
11	2015	1513528810	1,392,445,892.52	124	The park is open.
12	2015	1513528810	1,392,445,892.52	124	The park is open.
13	2015	1513528810	1,392,445,892.52	124	The park is open.
14	2015	1513528810	1,392,445,892.52	124	The park is open.
15	2015	1513528810	1,392,445,892.52	124	The park is open.
16	2015	1513528810	1,392,445,892.52	124	The park is open.
17	2015	1513528810	1,392,445,892.52	124	The park is open.
18	2015	1513528810	1,392,445,892.52	124	The park is open.
19	2015	1513528810	1,392,445,892.52	124	The park is open.
20	2015	1513528810	1,392,445,892.52	124	The park is open.
21	2015	1513528810	1,392,445,892.52	124	The park is open.
22	2015	1513528810	1,392,445,892.52	124	The park is open.

23	2015	1513528810	1,392,445,892.52	124	The park is open.
24	2015	1513528810	1,392,445,892.52	124	The park is open.
25	2015	1513528810	1,392,445,892.52	124	The park is open.
26	2015	1513528810	1,392,445,892.52	124	The park is open.
27	2015	1513528810	1,392,445,892.52	124	The park is open.
28	2015	1513528810	1,392,445,892.52	124	The park is open.
29	2015	1513528810	1,392,445,892.52	124	The park is open.
30	2015	1513528810	1,392,445,892.52	124	The park is open.
31	2015	1513528810	1,392,445,892.52	124	The park is open.
32	2015	1513528810	1,392,445,892.52	124	The park is open.
33	2015	1513528810	1,392,445,892.52	124	The park is open.
34	2015	1513528810	1,392,445,892.52	124	The park is open.
35	2015	1513528810	1,392,445,892.52	124	The park is open.
36	2015	1513528810	1,392,445,892.52	124	The park is open.
37	2015	1513528810	1,392,445,892.52	124	The park is open.
38	2015	1513528810	1,392,445,892.52	124	The park is open.
39	2015	1513528810	1,392,445,892.52	124	The park is open.
40	2015	1513528810	1,392,445,892.52	124	The park is open.
41	2015	1513528810	1,392,445,892.52	124	The park is open.
42	2015	1513528810	1,392,445,892.52	124	The park is open.
43	2015	1513528810	1,392,445,892.52	124	The park is open.
44	2015	1513528810	1,392,445,892.52	124	The park is open.
45	2015	1513528810	1,392,445,892.52	124	The park is open.
46	2015	1513528810	1,392,445,892.52	124	The park is open.
47	2015	1513528810	1,392,445,892.52	124	The park is open.
48	2015	1513528810	1,392,445,892.52	124	The park is open.
49	2015	1513528810	1,392,445,892.52	124	The park is open.

	vote_average	vote_count
0	6.50	5562
1	6.50	5562
2	6.50	5562
3	6.50	5562
4	6.50	5562
5	6.50	5562
6	6.50	5562
7	6.50	5562
8	6.50	5562
9	6.50	5562
10	6.50	5562
11	6.50	5562
12	6.50	5562
13	6.50	5562
14	6.50	5562
15	6.50	5562
16	6.50	5562
17	6.50	5562
18	6.50	5562

```
19      6.50    5562
20      6.50    5562
21      6.50    5562
22      6.50    5562
23      6.50    5562
24      6.50    5562
25      6.50    5562
26      6.50    5562
27      6.50    5562
28      6.50    5562
29      6.50    5562
30      6.50    5562
31      6.50    5562
32      6.50    5562
33      6.50    5562
34      6.50    5562
35      6.50    5562
36      6.50    5562
37      6.50    5562
38      6.50    5562
39      6.50    5562
40      6.50    5562
41      6.50    5562
42      6.50    5562
43      6.50    5562
44      6.50    5562
45      6.50    5562
46      6.50    5562
47      6.50    5562
48      6.50    5562
49      6.50    5562
```

[50 rows x 22 columns]

To keep things clean, I am going to make separate dataframes:

- df_film will contain only columns I won't be summing or averaging (such as genre and cast)
- df_vals will contain the remaining

```
In [19]: df_film = df_flat.drop(columns=[
    'budget', 'budget_adj', 'net_income', 'revenue', 'revenue_adj',
    'vote_average', 'vote_count'
])
df_film.head()
```

```
Out[19]:      cast      director  genres      homepage \
0  Chris Pratt  Colin Trevorrow  Action  http://www.jurassicworld.com/
1  Chris Pratt  Colin Trevorrow  Action  http://www.jurassicworld.com/
```

```

2 Chris Pratt Colin Trevorrow Action http://www.jurassicworld.com/
3 Chris Pratt Colin Trevorrow Action http://www.jurassicworld.com/
4 Chris Pratt Colin Trevorrow Action http://www.jurassicworld.com/

      id     imdb_id          keywords original_title \
0 135397  tt0369610        monster Jurassic World
1 135397  tt0369610        dna Jurassic World
2 135397  tt0369610  tyrannosaurus rex Jurassic World
3 135397  tt0369610    velociraptor Jurassic World
4 135397  tt0369610       island Jurassic World

                           overview popularity \
0 Twenty-two years after the events of Jurassic ...      32.99
1 Twenty-two years after the events of Jurassic ...      32.99
2 Twenty-two years after the events of Jurassic ...      32.99
3 Twenty-two years after the events of Jurassic ...      32.99
4 Twenty-two years after the events of Jurassic ...      32.99

      production_companies release_date \
0 Universal Studios|Amblin Entertainment|Legenda... 2015-06-09
1 Universal Studios|Amblin Entertainment|Legenda... 2015-06-09
2 Universal Studios|Amblin Entertainment|Legenda... 2015-06-09
3 Universal Studios|Amblin Entertainment|Legenda... 2015-06-09
4 Universal Studios|Amblin Entertainment|Legenda... 2015-06-09

      release_year   runtime         tagline
0           2015      124  The park is open.
1           2015      124  The park is open.
2           2015      124  The park is open.
3           2015      124  The park is open.
4           2015      124  The park is open.

```

```
In [20]: df_vals = df_flat.drop(columns=['genres', 'cast', 'keywords'])
df_vals.drop_duplicates(inplace=True)
df_vals.head()
```

```
Out[20]:      budget   budget_adj      director \
0  150000000  137,999,939.28  Colin Trevorrow
100 150000000  137,999,939.28  George Miller
200 110000000  101,199,955.47 Robert Schwentke
275 200000000  183,999,919.04    J.J. Abrams
375 190000000  174,799,923.09    James Wan

                           homepage      id     imdb_id \
0  http://www.jurassicworld.com/  135397  tt0369610
100  http://www.madmaxmovie.com/  76341  tt1392190
200  http://www.thedivergentseries.movie/#insurgent  262500  tt2908446
275  http://www.starwars.com/films/star-wars-episod...  140607  tt2488496
```

```

375                                         http://www.furious7.com/ 168259 tt2820852

          net_income          original_title \
0    1,254,445,953.24        Jurassic World
100   210,161,353.21        Mad Max: Fury Road
200   170,419,069.94        Insurgent
275  1,718,723,210.76      Star Wars: The Force Awakens
375  1,210,948,878.38      Furious 7

                           overview popularity \
0    Twenty-two years after the events of Jurassic ...      32.99
100   An apocalyptic story set in the furthest reach...      28.42
200   Beatrice Prior must confront her inner demons ...      13.11
275   Thirty years after defeating the Galactic Empi...      11.17
375   Deckard Shaw seeks revenge against Dominic Tor...      9.34

          production_companies release_date \
0    Universal Studios|Amblin Entertainment|Legenda... 2015-06-09
100  Village Roadshow Pictures|Kennedy Miller Produ... 2015-05-13
200  Summit Entertainment|Mandeville Films|Red Wago... 2015-03-18
275    Lucasfilm|Truenorth Productions|Bad Robot 2015-12-15
375  Universal Pictures|Original Film|Media Rights ... 2015-04-01

       release_year     revenue     revenue_adj    runtime \
0            2015  1513528810  1,392,445,892.52      124
100           2015   378436354   348,161,292.49      120
200           2015   295238201   271,619,025.41      119
275           2015  2068178225  1,902,723,129.80      136
375           2015  1506249360  1,385,748,801.47      137

          tagline    vote_average    vote_count
0    The park is open.        6.50        5562
100  What a Lovely Day.        7.10        6185
200  One Choice Can Destroy You        6.30        2480
275  Every generation has a story.        7.50        5292
375  Vengeance Hits Home        7.30        2947

```

Exploratory Data Analysis

1.3.1 Research Question 1: Which movies were most and least profitable?

```
In [21]: idx = df_vals.net_income.idxmax()
idx
```

```
Out[21]: 9910
```

```
In [22]: # The most profitable movie
df_vals.loc[idx]
```

```
Out[22]: budget                                11000000
          budget_adj                           39,575,591.36
          director                             George Lucas
          homepage                            http://www.starwars.com/films/star-wars-episod...
          id                                    11
          imdb_id                            tt0076759
          net_income                           2,750,136,650.92
          original_title                      Star Wars
          overview                            Princess Leia is captured and held hostage by ...
          popularity                           12.04
          production_companies    Lucasfilm|Twentieth Century Fox Film Corporation
          release_date                          1977-03-20 00:00:00
          release_year                          1977
          revenue                             775398007
          revenue_adj                           2,789,712,242.28
          runtime                             121
          tagline                             A long time ago in a galaxy far, far away...
          vote_average                         7.90
          vote_count                           4428
          Name: 9910, dtype: object
```

```
In [23]: idx1 = df_vals.net_income.idxmin()
          idx1
```

```
Out[23]: 23771
```

```
In [24]: # The lease profitable movie
          df_vals.loc[idx1]
```

```
Out[24]: budget                                425000000
          budget_adj                           425,000,000.00
          director                             Sngmoo Lee
          homepage                            http://www.iamrogue.com/thewarriorsway
          id                                    46528
          imdb_id                            tt1032751
          net_income                           -413,912,431.00
          original_title                      The Warrior's Way
          overview                            An Asian assassin (Dong-gun Jang) is forced to...
          popularity                           0.25
          production_companies    Boram Entertainment Inc.
          release_date                          2010-12-02 00:00:00
          release_year                          2010
          revenue                             11087569
          revenue_adj                           11,087,569.00
          runtime                             100
          tagline                             Assassin. Hero. Legend.
          vote_average                         6.40
          vote_count                           74
          Name: 23771, dtype: object
```

1.3.2 Research Question 2: What was the most profitable movie each year?

```
In [25]: idx = df.groupby(['release_year'])['net_income'].transform(max) == df['net_income']
df[idx].sort_values(['release_year'], ascending=True)[['id', 'original_title', 'release_year', 'budget_adj', 'net_income']]
```

```
Out[25]:      id          original_title  release_year \
10143    967            Spartacus        1960
10110   12230  One Hundred and One Dalmatians        1961
9849     646             Dr. No        1962
10438     657  From Russia With Love        1963
9881     658           Goldfinger        1964
10690   15121       The Sound of Music        1965
10822     396  Who's Afraid of Virginia Woolf?        1966
10398   9325        The Jungle Book        1967
9719      62        2001: A Space Odyssey        1968
10725     642  Butch Cassidy and the Sundance Kid        1969
10654   9062            Love Story        1970
9925     681        Diamonds Are Forever        1971
7269     238            The Godfather        1972
10594   9552            The Exorcist        1973
9767   11072        Blazing Saddles        1974
9806     578              Jaws        1975
10208   19610         A Star Is Born        1976
1329      11            Star Wars        1977
10758   1924            Superman        1978
7833   1367            Rocky II        1979
7309   1891        The Empire Strikes Back        1980
8375      85        Raiders of the Lost Ark        1981
8889     601        E.T. the Extra-Terrestrial        1982
7987   1892        Return of the Jedi        1983
7883      87  Indiana Jones and the Temple of Doom        1984
6081     105        Back to the Future        1985
10475     744            Top Gun        1986
9613   10998        Fatal Attraction        1987
9454     380            Rain Man        1988
9180     89  Indiana Jones and the Last Crusade        1989
9986     251              Ghost        1990
9317     280        Terminator 2: Judgment Day        1991
8243     812            Aladdin        1992
10223     329        Jurassic Park        1993
4180   8587            The Lion King        1994
8094   1642              The Net        1995
8457     602        Independence Day        1996
5231     597              Titanic        1997
8970      95            Armageddon        1998
2412   1893  Star Wars: Episode I - The Phantom Menace        1999
8666     955        Mission: Impossible II        2000
2634     671  Harry Potter and the Philosopher's Stone        2001
```

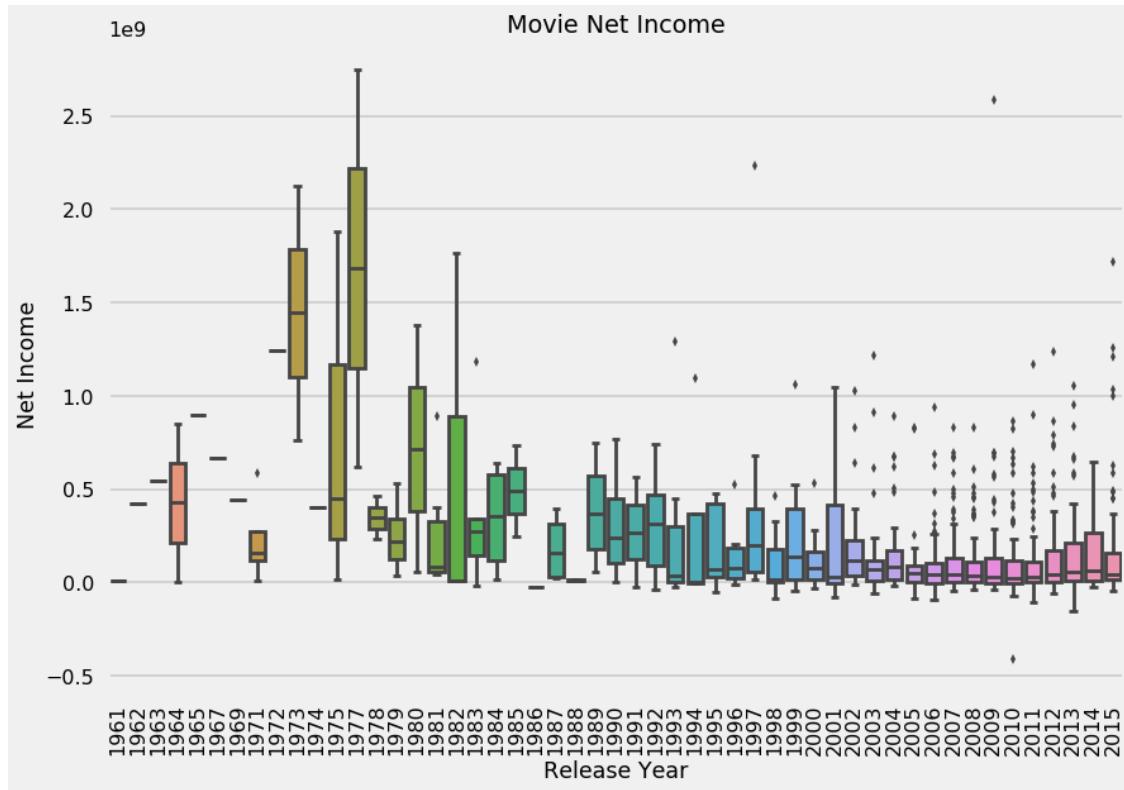
3911	121	The Lord of the Rings: The Two Towers	2002
4949	122	The Lord of the Rings: The Return of the King	2003
6977	809	Shrek 2	2004
6190	674	Harry Potter and the Goblet of Fire	2005
6555	58	Pirates of the Caribbean: Dead Man's Chest	2006
7388	675	Harry Potter and the Order of the Phoenix	2007
2875	155	The Dark Knight	2008
1386	19995	Avatar	2009
1930	10193	Toy Story 3	2010
3374	12445	Harry Potter and the Deathly Hallows: Part 2	2011
4361	24428	The Avengers	2012
5422	109445	Frozen	2013
634	122917	The Hobbit: The Desolation of Smaug	2014
3	140607	Star Wars: The Force Awakens	2015

		budget_adj	net_income
10143		88,475,609.49	353,902,437.95
10110		29,179,444.83	1,545,635,294.87
9849		7,929,293.77	421,694,259.41
10438		17,800,448.43	543,972,910.57
9881		24,605,935.94	853,474,463.61
10690		56,748,622.29	1,072,786,239.70
10822		50,385,110.19	176,258,462.18
10398		26,147,054.96	1,319,404,004.03
9719		75,227,563.38	280,319,033.83
10725		35,665,585.21	572,485,481.13
10654		12,356,010.36	753,716,631.75
9925		38,773,403.38	585,909,206.69
7269		31,287,365.59	1,246,626,366.80
10594		39,289,276.63	2,128,035,624.57
9767		11,497,938.11	516,964,986.57
9806		28,362,748.20	1,878,643,093.71
10208		22,990,188.17	593,913,194.41
1329		39,575,591.36	2,750,136,650.92
10758		183,848,538.22	819,690,439.17
7833		21,031,878.02	580,426,232.04
7309		47,628,661.55	1,376,997,526.22
8375		43,167,434.49	891,949,443.74
8889		23,726,245.23	1,767,968,064.02
7987		70,824,243.13	1,182,994,737.99
7883		58,773,177.10	640,207,821.95
6081		38,516,154.99	734,056,616.72
10475		29,841,096.16	680,039,989.06
9613		26,867,126.13	587,518,210.63
9454		46,097,275.58	608,162,158.78
9180		84,431,277.07	749,629,788.20
9986		36,715,767.89	806,077,994.97
9317		160,109,284.19	672,458,993.61

8243	43,512,679.13	739,793,586.73
10223	95,096,607.59	1,293,766,704.17
4180	66,200,020.27	1,093,391,569.74
8094	31,481,271.08	1,551,568,265.28
8457	104,266,255.42	1,031,498,096.17
5231	271,692,064.21	2,234,713,671.21
8970	187,277,365.67	553,537,804.54
2412	150,541,077.36	1,059,439,453.10
8666	158,286,514.29	533,600,434.44
2634	153,936,014.59	1,048,582,021.48
3911	95,768,650.10	1,027,133,804.32
4949	111,423,148.61	1,214,854,861.87
6977	173,166,809.97	888,736,812.77
6190	167,484,493.45	832,868,045.78
6555	216,333,831.66	936,357,520.21
7388	157,750,287.39	828,938,572.98
2875	187,365,527.25	827,367,505.23
1386	240,886,902.89	2,586,236,847.52
1930	200,000,000.00	863,171,911.00
3374	121,174,755.32	1,166,009,242.24
4361	208,943,741.90	1,234,247,693.31
5422	140,405,002.91	1,052,306,488.21
634	230,272,762.69	649,479,526.45
3	183,999,919.04	1,718,723,210.76

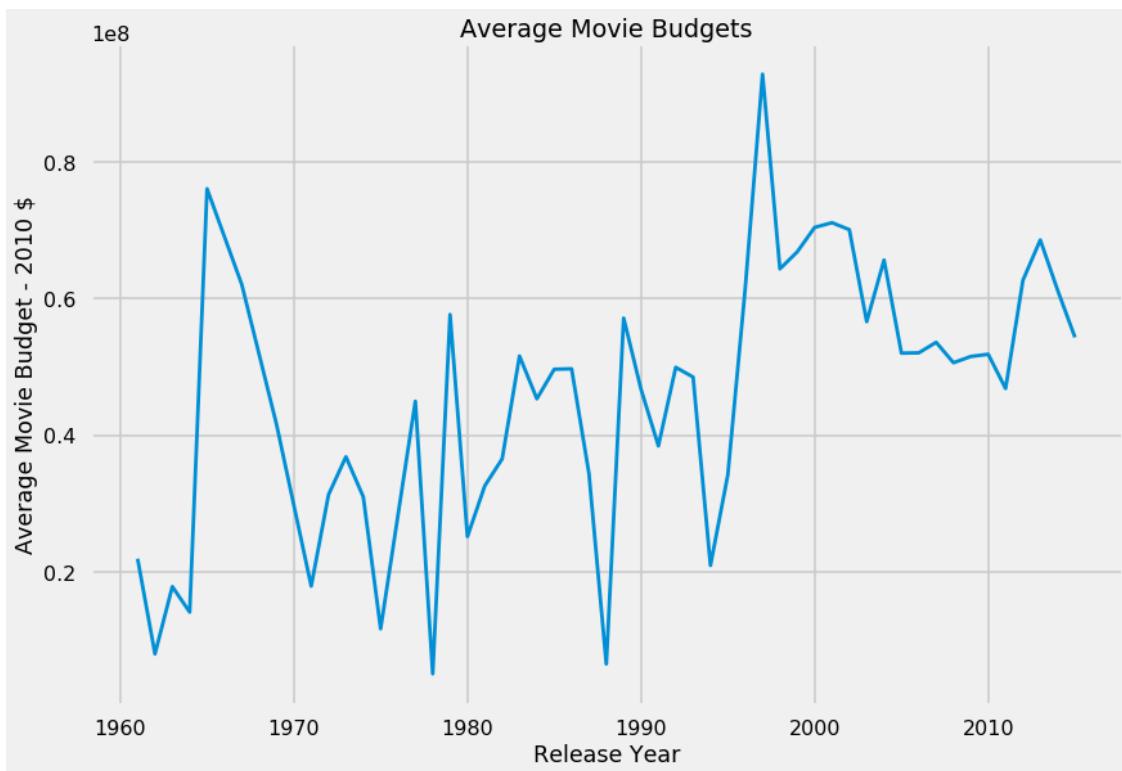
In [26]: # What is the distribution of net income by year?

```
ax = sns.boxplot(x='release_year',
                  y='net_income',
                  data=df_vals)
ax.set_xticklabels(ax.get_xticklabels(), rotation=90)
plt.xlabel('Release Year')
plt.ylabel('Net Income')
plt.title('Movie Net Income')
plt.show()
```



Research Question 3: Do movie budgets increase over time?

```
In [27]: # What is the average budget of the movies released each year?
plt.plot(df_vals[df_vals['budget_adj'] > 0].groupby('release_year').budget_adj.mean())
plt.xlabel('Release Year')
plt.ylabel('Average Movie Budget - 2010 $')
plt.title('Average Movie Budgets')
plt.show()
```



In [28]: # What were the biggest movie budgets of all time?

```
df_vals.sort_values(['budget_adj'], ascending=False)[['id', 'original_title', 'release_year']].head(10)
```

Out[28]:

			original_title	release_year	\
23771	46528		The Warrior's Way	2010	
31499	1865	Pirates of the Caribbean: On Stranger Tides		2011	
65204	285	Pirates of the Caribbean: At World's End		2007	
49789	597		Titanic	1997	
65804	559		Spider-Man 3	2007	
17590	38757		Tangled	2010	
1200	99861	Avengers: Age of Ultron		2015	
10260	767	Harry Potter and the Half-Blood Prince		2009	
17140	12444	Harry Potter and the Deathly Hallows: Part 1		2010	
45094	49529		John Carter	2012	

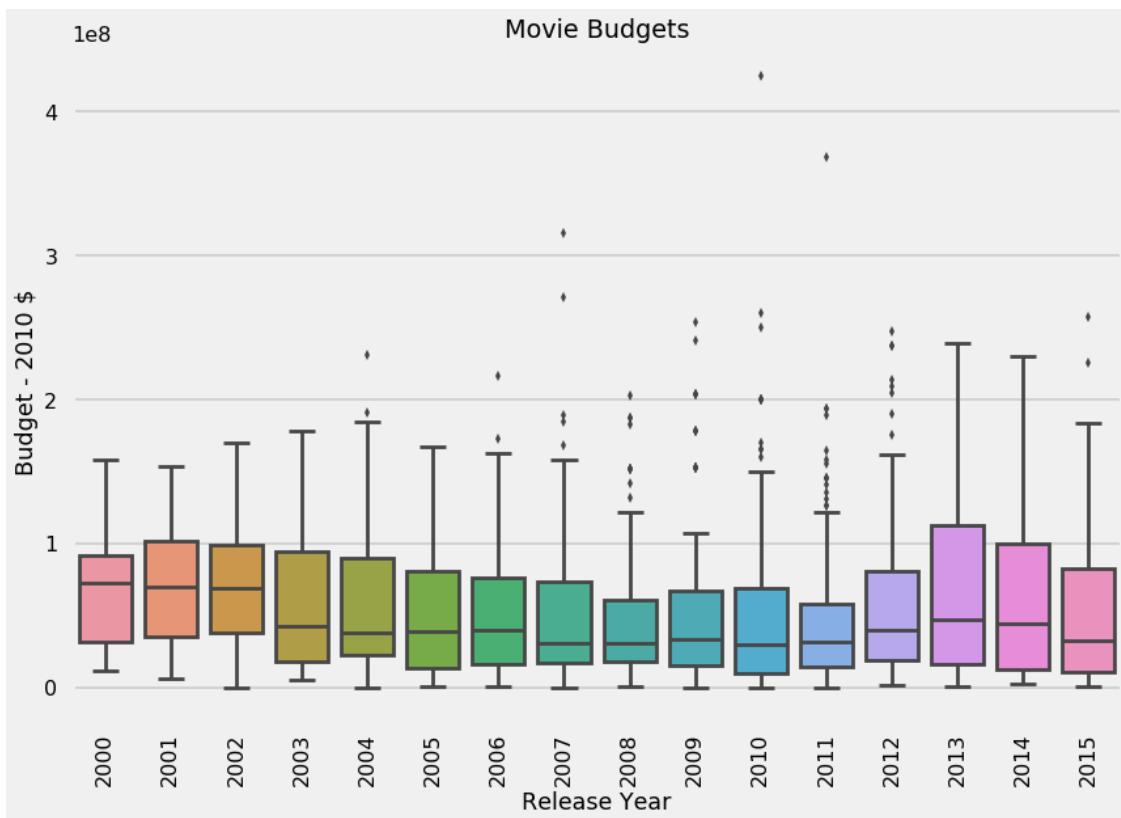
	budget_adj	net_income
23771	425,000,000.00	-413,912,431.00
31499	368,371,256.18	622,046,244.16
65204	315,500,574.79	695,152,933.12
49789	271,692,064.21	2,234,713,671.21
65804	271,330,494.32	665,571,205.90
17590	260,000,000.00	331,794,936.00

```

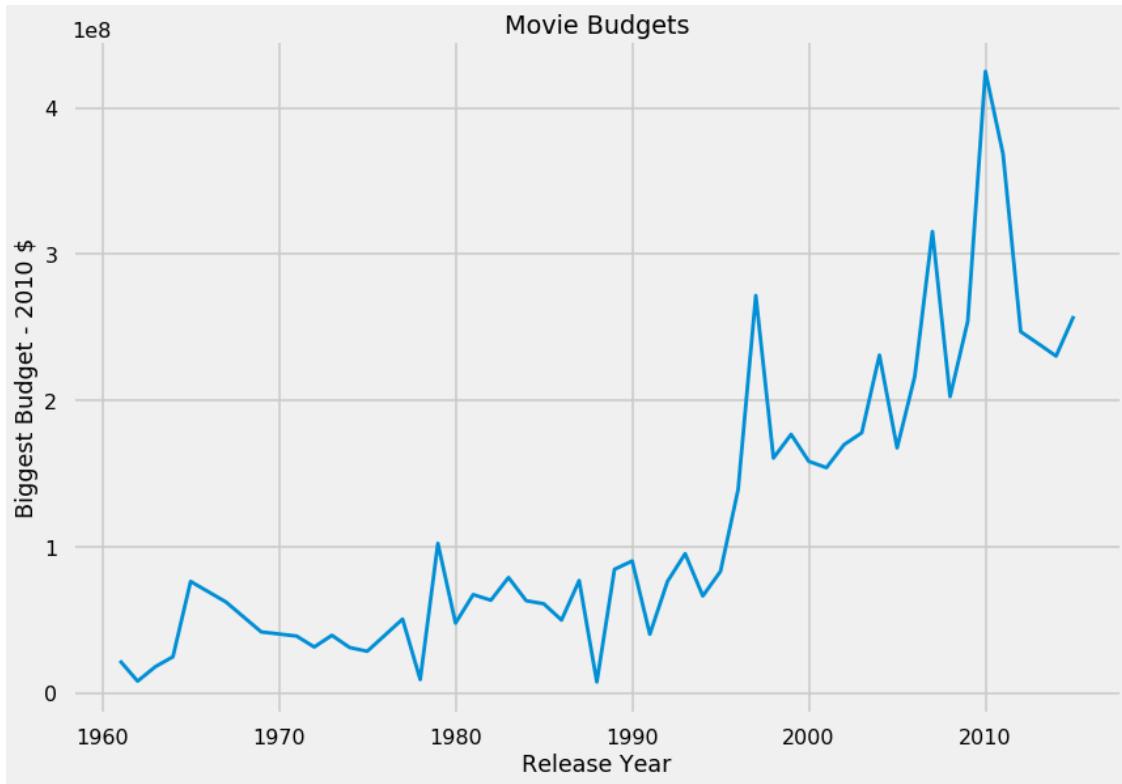
1200 257,599,886.66 1,035,032,450.23
10260 254,100,108.53 695,176,424.75
17140 250,000,000.00 704,305,868.00
45094 246,933,513.15 22,925,972.18

```

```
In [29]: # Drop movies with >0 budget, only year 2000+
df_vals2000 = df_vals.query('budget_adj > 0 & release_year >= 2000')
ax = sns.boxplot(x='release_year',
                  y='budget_adj',
                  data=df_vals2000)
ax.set_xticklabels(ax.get_xticklabels(), rotation=90)
plt.xlabel('Release Year')
plt.ylabel('Budget - 2010 $')
plt.title('Movie Budgets')
plt.show()
```



```
In [30]: # What was the most expensive movie released each year?
plt.plot(df_vals[df_vals['budget_adj'] > 0].groupby('release_year').budget_adj.max())
plt.xlabel('Release Year')
plt.ylabel('Biggest Budget - 2010 $')
plt.title('Movie Budgets')
plt.show()
```



1.3.3 Research Question 4: What is the most profitable genre?

```
In [31]: # Join the two dfs on the id key
result = pd.merge(df_film, df_vals, on='id', how='inner')

In [32]: result = result[['id', 'original_title_x', 'genres', 'revenue_adj', 'budget_adj', 'net_i
          result.rename(columns={'original_title_x': 'original_title'}, inplace=True)

          # We have a bunch of duplicates from the expanded set, remove them
          result.drop_duplicates(inplace=True)
          result.head()

Out[32]:      id    original_title      genres      revenue_adj \
0    135397    Jurassic World    Action  1,392,445,892.52
5    135397    Jurassic World  Adventure  1,392,445,892.52
10   135397    Jurassic World  Science Fiction  1,392,445,892.52
15   135397    Jurassic World    Thriller  1,392,445,892.52
100  76341  Mad Max: Fury Road    Action   348,161,292.49

              budget_adj      net_income
0  137,999,939.28  1,254,445,953.24
5  137,999,939.28  1,254,445,953.24
```

```
10 137,999,939.28 1,254,445,953.24  
15 137,999,939.28 1,254,445,953.24  
100 137,999,939.28    210,161,353.21
```

```
In [33]: result.groupby('genres').net_income.sum().sort_values(ascending=False)
```

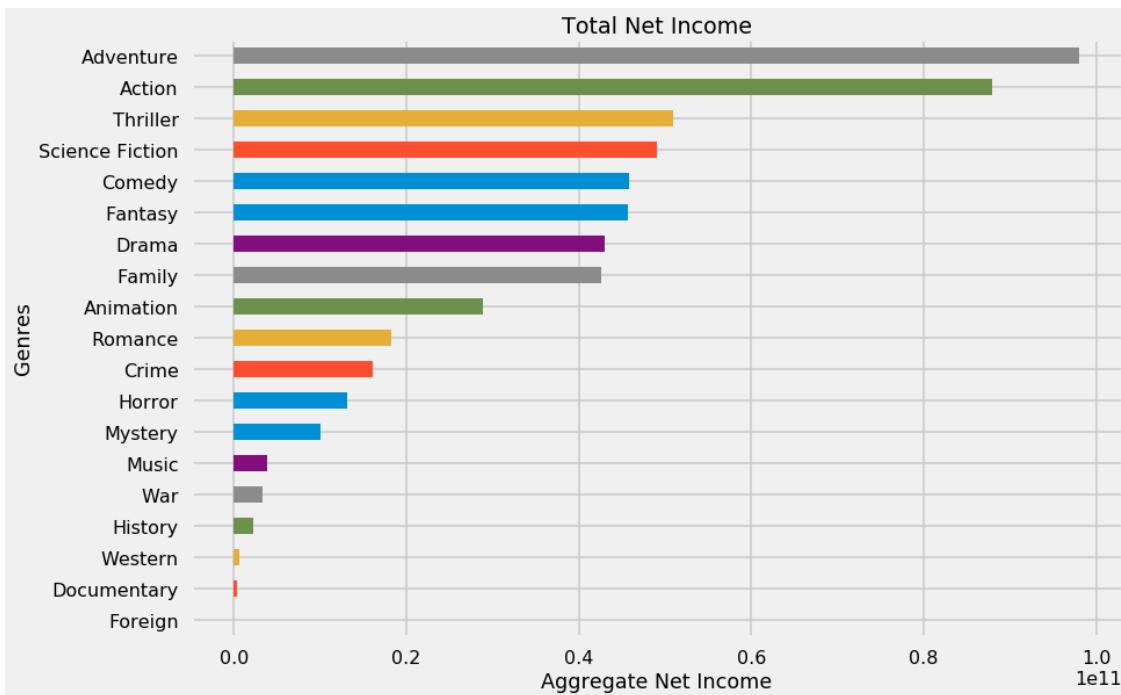
```
Out[33]: genres
```

Adventure	98,042,386,342.66
Action	87,874,227,105.53
Thriller	50,903,960,105.73
Science Fiction	49,058,392,574.84
Comedy	45,795,267,298.12
Fantasy	45,715,250,965.99
Drama	43,013,208,139.53
Family	42,587,558,778.80
Animation	28,823,610,050.17
Romance	18,211,014,055.05
Crime	16,132,383,057.04
Horror	13,179,400,828.52
Mystery	10,054,564,194.13
Music	3,881,078,931.43
War	3,342,155,586.45
History	2,288,072,621.76
Western	573,527,954.54
Documentary	309,092,494.58
Foreign	-1,312,284.00

Name: net_income, dtype: float64

```
In [34]: # Total income
```

```
result.groupby('genres')['net_income'].sum().sort_values(ascending=True).plot.barh(title='Aggregate Net Income')  
plt.xlabel('Aggregate Net Income')  
plt.ylabel('Genres')  
plt.show()
```



```
In [35]: result.groupby('genres').net_income.mean().sort_values(ascending=False)
```

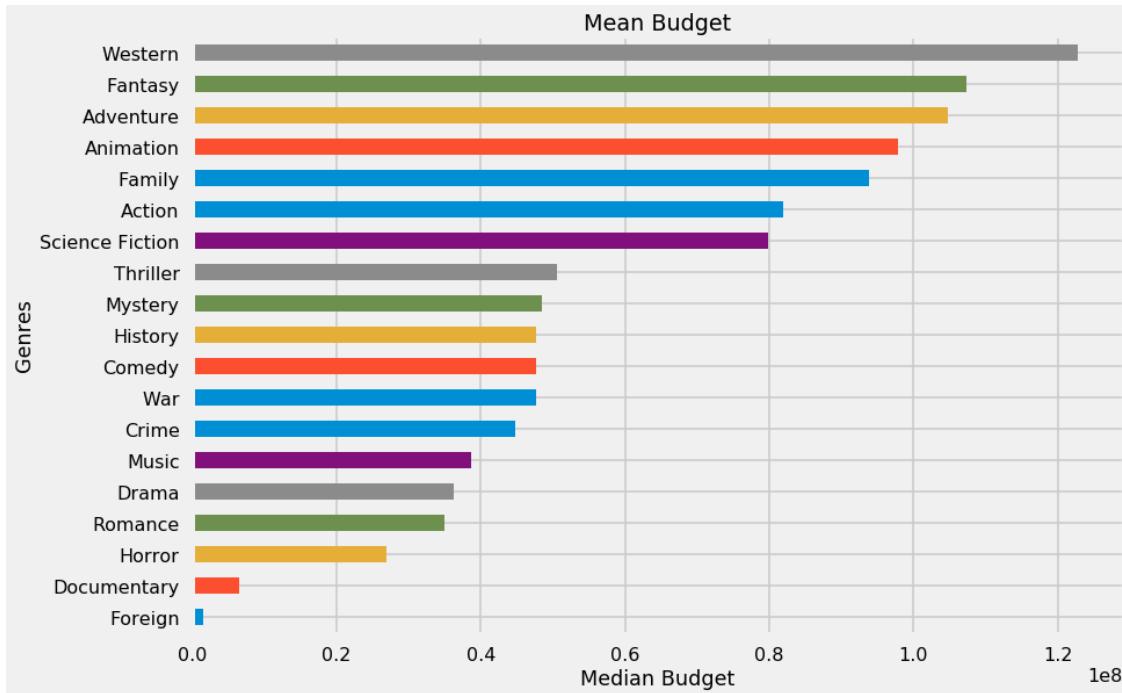
```
Out[35]: genres
```

Adventure	330,109,044.92
Fantasy	296,852,279.00
Animation	266,885,278.24
Family	261,273,366.74
Science Fiction	234,729,151.08
Action	211,745,125.56
Thriller	127,578,847.38
Comedy	110,616,587.68
War	104,442,362.08
Mystery	102,597,593.82
Music	102,133,656.09
Horror	94,815,833.30
Romance	92,913,337.02
Crime	83,587,476.98
Drama	80,398,519.89
History	65,373,503.48
Western	44,117,534.96
Documentary	20,606,166.31
Foreign	-1,312,284.00

Name: net_income, dtype: float64

```
In [36]: result.groupby('genres')['budget_adj'].mean().sort_values(ascending=True).plot.barh(title='Median Budget')
```

```
plt.ylabel('Genres')
plt.show()
```



Conclusions

1.3.4 Which movies were most and least profitable?

The five most profitable movies in history (using inflation-adjusted 2010 dollars) are: (1) *Star Wars* (2) *Avatar* (3) *Titanic* (4) *The Exorcist* (5) *Jaws*. The least profitable movies are (1) *The Lone Ranger* (2) *Mars Needs Moms* (3) *Flushed Away* (4) *Sphere* (5) *A Sound of Thunder*.

1.3.5 What was the most profitable movie each year?

Above I list the most profitable movies for every year from 1960 to 2015, in inflation-adjusted 2010 dollars. They ranged from *Spartacus* (1960) to *Star Wars: The Force Awakens* (2015). It was interesting to note that three of the most five most profitable movies of all time were released in the 1970s. Only 22 movies in history have made over one billion dollars and four of them were released in the 1970s (the three just listed as well as *The Godfather*).

1.3.6 Have movie budgets increased over time?

There's an interesting answer to this question: sort of. The median movie budget has actually declined since 2000. But the budgets for the biggest budget movies have increased significantly, increasing by 60% since 2000.

1.3.7 What is the most profitable genre?

The most profitable genres – measured by total profits across the entire category – are Adventure, Action, and Thrillers. Looking at median profitability, the categories are Adventure, Animation, and Fantasy. These two lists are different because median controls for the number of movies released. Although Animation and Fantasy are profitable categories, fewer of those movies are produced. I saw similar effects when I looked at budgets.

Limitations: Several movies had 0 for budget and/or revenue. There might be more or less profitable movies where the data was missing.

```
In [ ]: from subprocess import call  
call(['python', '-m', 'nbconvert', 'Investigate_a_Dataset.ipynb'])
```