Business Understanding

The company would like to create a new movie studio for original video content, but we don't have any experience with making movies. Here, we want to explore what types of films are performing best at the box office currently in order to make recommendations about what type of films to create in our new studio.

Data Understanding

```
We are working with two datasets provided by IMDB and The
Numbers.  The data includes information about movies and their
genres, ratings, staff, domestic and international gross revenue,
budget, and more.
```

Data Preparation

Importing necessary libraries and getting a look at my two data sources below.

In [1]:

```python
import pandas as pd
import sqlite3
conn = sqlite3.connect('data/im.db')
```

In [2]:

```python
IMDB = pd.read_sql("""SELECT name FROM sqlite_master WHERE type =
IMDB
```

Out[2]:

	name
0	movie_basics
1	directors
2	known_for
3	movie_akas
4	movie_ratings
5	persons
6	principals
7	writers

In [3]:

```
pd.read_sql("SELECT * FROM movie_basics;", conn)
```

Out[3]:

	movie_id	primary_title	original_title	start_year	runtime_minutes	genre
0	tt0063540	Sunghursh	Sunghursh	2013	175.0	Action,Crime,Dram
1	tt0066787	One Day Before the Rainy Season	Ashad Ka Ek Din	2019	114.0	Biography,Dram
2	tt0069049	The Other Side of the Wind	The Other Side of the Wind	2018	122.0	Dram
3	tt0069204	Sabse Bada Sukh	Sabse Bada Sukh	2018	NaN	Comedy,Dram
4	tt0100275	The Wandering Soap Opera	La Telenovela Errante	2017	80.0	Comedy,Drama,Fantas
...	...	...	...	...	...	.
146139	tt9916538	Kuambil Lagi Hatiku	Kuambil Lagi Hatiku	2019	123.0	Dram
146140	tt9916622	Rodolpho Teóphilo - O Legado de um Pioneiro	Rodolpho Teóphilo - O Legado de um Pioneiro	2015	NaN	Documentar
146141	tt9916706	Dankyavar Danka	Dankyavar Danka	2013	NaN	Comec
146142	tt9916730	6 Gunn	6 Gunn	2017	116.0	Non
146143	tt9916754	Chico Albuquerque - Revelações	Chico Albuquerque - Revelações	2013	NaN	Documentar

146144 rows × 6 columns

I might like to make recommendations for genres and writers, so I'm going to pull that information from the database and combine it into a dataframe for easier manipulation.

In [4]:

```
query = '''
SELECT
    mb.*,
    p.primary_name AS writer_name
FROM
    movie_basics AS mb
JOIN
    writers AS w ON mb.movie_id = w.movie_id
JOIN
    persons AS p ON w.person_id = p.person_id;
'''

IMDB_df = pd.read_sql(query, conn)
IMDB_df
```

Out[4]:

	movie_id	primary_title	original_title	start_year	runtime_minutes	genres
0	tt0063540	Sunghursh	Sunghursh	2013	175.0	Action,Crime,Drama
1	tt0063540	Sunghursh	Sunghursh	2013	175.0	Action,Crime,Drama
2	tt0063540	Sunghursh	Sunghursh	2013	175.0	Action,Crime,Drama
3	tt0063540	Sunghursh	Sunghursh	2013	175.0	Action,Crime,Drama
4	tt0069049	The Other Side of the Wind	The Other Side of the Wind	2018	122.0	Drama
...	...	...	...	...	...	...
255866	tt9916730	6 Gunn	6 Gunn	2017	116.0	None
255867	tt9916754	Chico Albuquerque - Revelações	Chico Albuquerque - Revelações	2013	NaN	Documentary
255868	tt9916754	Chico Albuquerque - Revelações	Chico Albuquerque - Revelações	2013	NaN	Documentary
255869	tt9916754	Chico Albuquerque - Revelações	Chico Albuquerque - Revelações	2013	NaN	Documentary
255870	tt9916754	Chico Albuquerque - Revelações	Chico Albuquerque - Revelações	2013	NaN	Documentary

255871 rows × 7 columns

In [5]:

```
conn.close()
```

In [6]:

```
TN = pd.read_csv('data/tn.movie_budgets.csv.gz')
```

In [7]:

```python
TN.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 5782 entries, 0 to 5781
Data columns (total 6 columns):
 #   Column             Non-Null Count  Dtype 
---  ------             --------------  ----- 
 0   id                 5782 non-null   int64 
 1   release_date       5782 non-null   object
 2   movie              5782 non-null   object
 3   production_budget  5782 non-null   object
 4   domestic_gross     5782 non-null   object
 5   worldwide_gross    5782 non-null   object
dtypes: int64(1), object(5)
memory usage: 271.2+ KB
```

In [8]:

```python
TN.head()
```

Out[8]:

	id	release_date	movie	production_budget	domestic_gross	worldwide_gross
0	1	Dec 18, 2009	Avatar	$425,000,000	$760,507,625	$2,776,345,279
1	2	May 20, 2011	Pirates of the Caribbean: On Stranger Tides	$410,600,000	$241,063,875	$1,045,663,875
2	3	Jun 7, 2019	Dark Phoenix	$350,000,000	$42,762,350	$149,762,350
3	4	May 1, 2015	Avengers: Age of Ultron	$330,600,000	$459,005,868	$1,403,013,963
4	5	Dec 15, 2017	Star Wars Ep. VIII: The Last Jedi	$317,000,000	$620,181,382	$1,316,721,747

I can calculate ROI from the information in this file, so that seems like a good way to evaluate the success of a movie. Release date is another variable I'd like to check out for correlation with ROI. Below I will combine writers, genres, release date, and calculate ROI, combining all into a dataframe I can use for analysis. First I'm changing monetary column values from string to integer in order to perform mathematical operations, removing the dollar signs and commas and such...

In [9]:

```python
columns_without_symbols = ['production_budget', 'domestic_gross',

for col in columns_without_symbols:
    TN[col] = TN[col].str.replace('$', '', regex=False)
    TN[col] = TN[col].str.replace(',', '', regex=False)
```

In [12]:

```
TN.head()
```

Out[12]:

	id	release_date	movie	production_budget	domestic_gross	worldwide_gross
0	1	Dec 18, 2009	Avatar	425000000	760507625	2776345279
1	2	May 20, 2011	Pirates of the Caribbean: On Stranger Tides	410600000	241063875	1045663875
2	3	Jun 7, 2019	Dark Phoenix	350000000	42762350	149762350
3	4	May 1, 2015	Avengers: Age of Ultron	330600000	459005868	1403013963
4	5	Dec 15, 2017	Star Wars Ep. VIII: The Last Jedi	317000000	620181382	1316721747

Converting to numeric, and then I'm going to calculate profit and ROI from the values provided above, so that I can use ROI as a measure of movie success moving forward.

In [13]:

```
converted_columns = ['production_budget', 'domestic_gross', 'worl
for col in converted_columns:
    TN[col] = pd.to_numeric(TN[col], errors='coerce')
```

In [14]:

```
TN['profit'] = (TN['domestic_gross'] + TN['worldwide_gross']) - T
TN.head()
```

Out[14]:

	id	release_date	movie	production_budget	domestic_gross	worldwide_gross	pro
0	1	Dec 18, 2009	Avatar	425000000	760507625	2776345279	31118529
1	2	May 20, 2011	Pirates of the Caribbean: On Stranger Tides	410600000	241063875	1045663875	8761277
2	3	Jun 7, 2019	Dark Phoenix	350000000	42762350	149762350	-1574753
3	4	May 1, 2015	Avengers: Age of Ultron	330600000	459005868	1403013963	15314198
4	5	Dec 15, 2017	Star Wars Ep. VIII: The Last Jedi	317000000	620181382	1316721747	16199031

Note that we report ROI as a percentage, so we multiply by 100.

In [15]:

```
TN['ROI'] = (TN['profit'] / TN['production_budget']) * 100
TN.head()
```

Out[15]:

	id	release_date	movie	production_budget	domestic_gross	worldwide_gross	pro
0	1	Dec 18, 2009	Avatar	425000000	760507625	2776345279	31118529
1	2	May 20, 2011	Pirates of the Caribbean: On Stranger Tides	410600000	241063875	1045663875	8761277
2	3	Jun 7, 2019	Dark Phoenix	350000000	42762350	149762350	-1574753
3	4	May 1, 2015	Avengers: Age of Ultron	330600000	459005868	1403013963	15314198
4	5	Dec 15, 2017	Star Wars Ep. VIII: The Last Jedi	317000000	620181382	1316721747	16199031

Release date, or more specifically the time of year a movie is released, may have some correlation with ROI. Let's convert release_date to datetime and extract the month of release to better evaluate that.

In [16]:

```
TN['release_date'] = pd.to_datetime(TN['release_date'])
```

In [17]:

```
TN['release_month'] = TN['release_date'].dt.strftime('%b')
```

In [18]:

```
TN
```

Out[18]:

	id	release_date	movie	production_budget	domestic_gross	worldwide_gross	
0	1	2009-12-18	Avatar	425000000	760507625	2776345279	3111
1	2	2011-05-20	Pirates of the Caribbean: On Stranger Tides	410600000	241063875	1045663875	876
2	3	2019-06-07	Dark Phoenix	350000000	42762350	149762350	-157
3	4	2015-05-01	Avengers: Age of Ultron	330600000	459005868	1403013963	1531
4	5	2017-12-15	Star Wars Ep. VIII: The Last Jedi	317000000	620181382	1316721747	1619
...	...	...	...	...	...	...	
5777	78	2018-12-31	Red 11	7000	0	0	
5778	79	1999-04-02	Following	6000	48482	240495	2
5779	80	2005-07-13	Return to the Land of Wonders	5000	1338	1338	
5780	81	2015-09-29	A Plague So Pleasant	1400	0	0	
5781	82	2005-08-05	My Date With Drew	1100	181041	181041	3

5782 rows × 9 columns

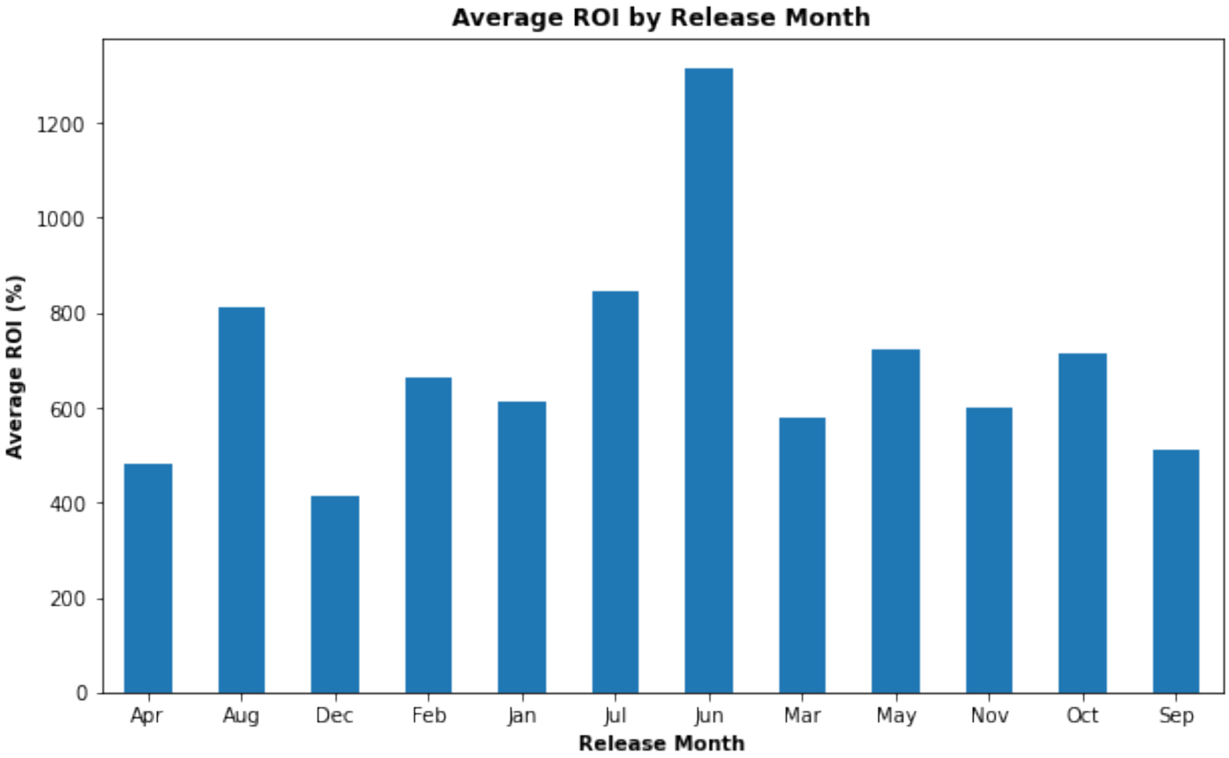
Exploratory Data Analysis

In [60]:

```
import matplotlib.pyplot as plt
ROI_by_month = TN.groupby('release_month')['ROI'].mean()

ROI_by_month.plot(kind='bar', figsize=(10,6))

plt.title('Average ROI by Release Month', fontweight='bold')
plt.xlabel('Release Month', fontweight='bold')
plt.ylabel('Average ROI (%)', fontweight='bold')
plt.xticks(rotation=0)
plt.show
plt.savefig('roi_by_month.png')
```



June, July, August! Summer looks good, and specifically early summer. Okay, now I'm going to combine the two data sources to get a look at genre and writers and see what kind of relationship exists, if any.

In [28]:

```
df = pd.merge(TN,
              IMDB_df[['primary_title', 'genres', 'writer_name']],
left_on='movie',
right_on='primary_title',
how='inner')
df
```

Out[28]:

	id	release_date	movie	production_budget	domestic_gross	worldwide_gross	
0	1	2009-12-18	Avatar	425000000	760507625	2776345279	3111
1	1	2009-12-18	Avatar	425000000	760507625	2776345279	3111
2	2	2011-05-20	Pirates of the Caribbean: On Stranger Tides	410600000	241063875	1045663875	876
3	2	2011-05-20	Pirates of the Caribbean: On Stranger Tides	410600000	241063875	1045663875	876
4	2	2011-05-20	Pirates of the Caribbean: On Stranger Tides	410600000	241063875	1045663875	876
...	...	...	...	...	...	...	
8522	73	2012-01-13	Newlyweds	9000	4584	4584	
8523	78	2018-12-31	Red 11	7000	0	0	
8524	78	2018-12-31	Red 11	7000	0	0	
8525	81	2015-09-29	A Plague So Pleasant	1400	0	0	
8526	81	2015-09-29	A Plague So Pleasant	1400	0	0	

8527 rows × 12 columns

Removing the primary_title column since it is now redundant.

In [29]:

```
df = df.drop('primary_title', axis=1)
df
```

Out[29]:

	id	release_date	movie	production_budget	domestic_gross	worldwide_gross	
0	1	2009-12-18	Avatar	425000000	760507625	2776345279	3111
1	1	2009-12-18	Avatar	425000000	760507625	2776345279	3111
2	2	2011-05-20	Pirates of the Caribbean: On Stranger Tides	410600000	241063875	1045663875	876
3	2	2011-05-20	Pirates of the Caribbean: On Stranger Tides	410600000	241063875	1045663875	876
4	2	2011-05-20	Pirates of the Caribbean: On Stranger Tides	410600000	241063875	1045663875	876
...	...	...	...	...	...	...	
8522	73	2012-01-13	Newlyweds	9000	4584	4584	
8523	78	2018-12-31	Red 11	7000	0	0	
8524	78	2018-12-31	Red 11	7000	0	0	
8525	81	2015-09-29	A Plague So Pleasant	1400	0	0	
8526	81	2015-09-29	A Plague So Pleasant	1400	0	0	

8527 rows × 11 columns

The genres column is kind of messy since many movies have multiple genres. I'm going to separate all of those genres out... it's fine for a movie to have multiple genres, but it's just easier to analyze if there is only one value in the genres column per row. I can use the comma separated values to separate them out so that these movies have multiple rows with just one genre each.

In [30]:

```
df_exploded = df.assign(genres=df['genres'].str.split(',')).explod
ROI_by_genre = df_exploded.groupby('genres')['ROI'].mean().sort_va
df_exploded
```

Out[30]:

	id	release_date	movie	production_budget	domestic_gross	worldwide_gross	
0	1	2009-12-18	Avatar	425000000	760507625	2776345279	31118
1	1	2009-12-18	Avatar	425000000	760507625	2776345279	31118
2	2	2011-05-20	Pirates of the Caribbean: On Stranger Tides	410600000	241063875	1045663875	876
2	2	2011-05-20	Pirates of the Caribbean: On Stranger Tides	410600000	241063875	1045663875	876
2	2	2011-05-20	Pirates of the Caribbean: On Stranger Tides	410600000	241063875	1045663875	876
...	...	...	...	...	...	...	
8525	81	2015-09-29	A Plague So Pleasant	1400	0	0	
8525	81	2015-09-29	A Plague So Pleasant	1400	0	0	
8526	81	2015-09-29	A Plague So Pleasant	1400	0	0	
8526	81	2015-09-29	A Plague So Pleasant	1400	0	0	
8526	81	2015-09-29	A Plague So Pleasant	1400	0	0	

18784 rows × 11 columns

Let's keep our data modern and relevant, as trends come and go and people might be interested in different kinds of movies today than they were in say, the 1940s. Let's use data back to 1995.

In [31]:

```
cutoff_date = pd.to_datetime('1995-01-01')
df_modern = df_exploded[df_exploded['release_date'] >= cutoff_date
df_modern
```

Out[31]:

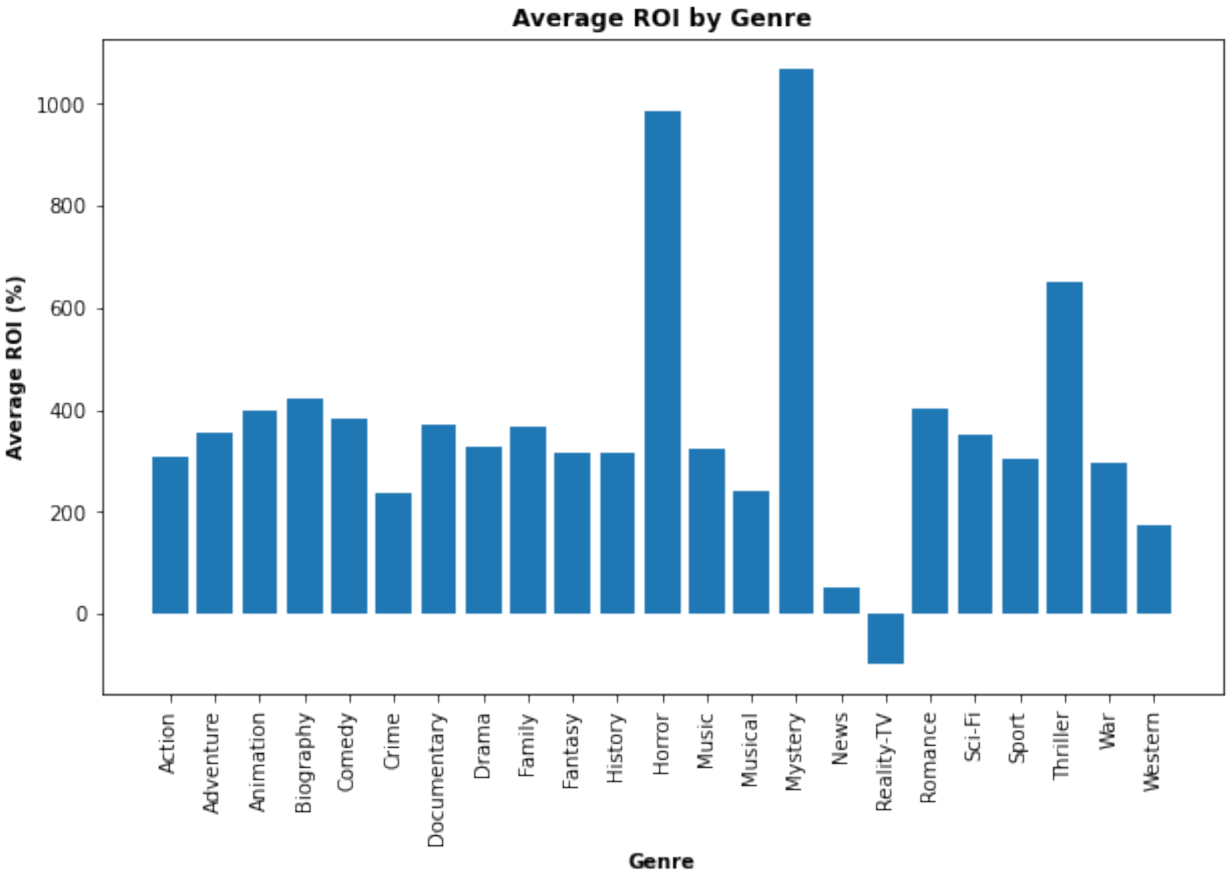
	id	release_date	movie	production_budget	domestic_gross	worldwide_gross	
0	1	2009-12-18	Avatar	425000000	760507625	2776345279	31118
1	1	2009-12-18	Avatar	425000000	760507625	2776345279	31118
2	2	2011-05-20	Pirates of the Caribbean: On Stranger Tides	410600000	241063875	1045663875	876
2	2	2011-05-20	Pirates of the Caribbean: On Stranger Tides	410600000	241063875	1045663875	876
2	2	2011-05-20	Pirates of the Caribbean: On Stranger Tides	410600000	241063875	1045663875	876
...	...	...	...	...	...	...	
8525	81	2015-09-29	A Plague So Pleasant	1400	0	0	
8525	81	2015-09-29	A Plague So Pleasant	1400	0	0	
8526	81	2015-09-29	A Plague So Pleasant	1400	0	0	
8526	81	2015-09-29	A Plague So Pleasant	1400	0	0	
8526	81	2015-09-29	A Plague So Pleasant	1400	0	0	

17901 rows × 11 columns

In [59]:

```python
ROI_by_genre = df_modern.groupby('genres')['ROI'].mean().reset_ind

plt.figure(figsize=(10, 6))
plt.bar(ROI_by_genre['genres'], ROI_by_genre['ROI'])
plt.title('Average ROI by Genre', fontweight='bold')
plt.xlabel('Genre', fontweight='bold')
plt.ylabel('Average ROI (%)', fontweight='bold')
plt.xticks(rotation=90)
plt.show
plt.savefig('ROI_by_genre.png')
```



Wow, look at mystery, horror and thriller! Those seems like great choices. Intuitively, that makes sense since they probably have lower production budgets most of the time. Let's get rid of the other genres in our data and find the best writers for these types of movies.

In [36]:

```python
best_genres = ['Horror', 'Mystery', 'Thriller']
df_filtered = df_modern[df_modern['genres'].isin(best_genres)]
df_filtered
```

Out[36]:

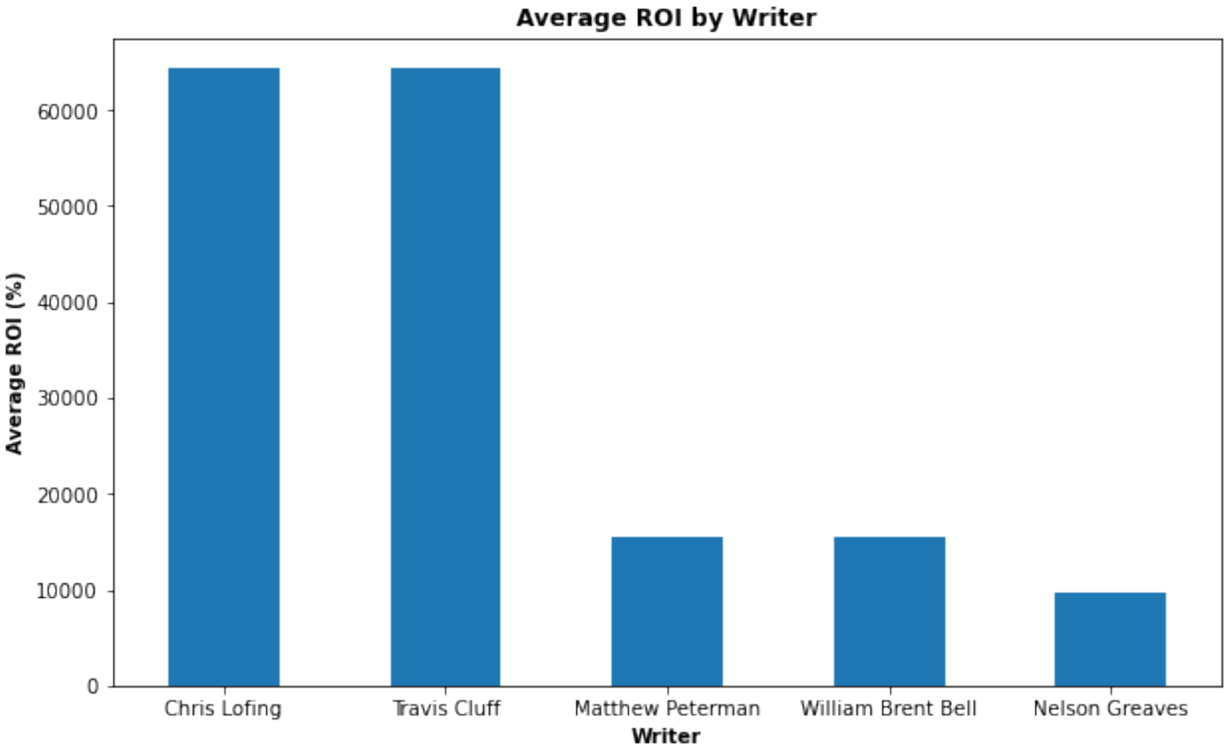
	id	release_date	movie	production_budget	domestic_gross	worldwide_gross	p
0	1	2009-12-18	Avatar	425000000	760507625	2776345279	311185
1	1	2009-12-18	Avatar	425000000	760507625	2776345279	311185
52	10	2015-11-06	Spectre	300000000	200074175	879620923	77969
53	10	2015-11-06	Spectre	300000000	200074175	879620923	77969
54	10	2015-11-06	Spectre	300000000	200074175	879620923	77969
...	...	...	...	...	...	...	
8524	78	2018-12-31	Red 11	7000	0	0	-
8525	81	2015-09-29	A Plague So Pleasant	1400	0	0	-
8525	81	2015-09-29	A Plague So Pleasant	1400	0	0	-
8526	81	2015-09-29	A Plague So Pleasant	1400	0	0	-
8526	81	2015-09-29	A Plague So Pleasant	1400	0	0	-

2456 rows × 11 columns

In [58]:

```
ROI_by_writer = df_filtered.groupby('writer_name')['ROI'].mean().r

plt.figure(figsize=(10, 6))
ROI_by_writer.plot(kind='bar')
plt.title('Average ROI by Writer', fontweight='bold')
plt.xlabel('Writer', fontweight='bold')
plt.ylabel('Average ROI (%)', fontweight='bold')
plt.xticks(rotation=360)
plt.show
plt.savefig('ROI_by_writer.png')
```



It looks like Chris Lofing, Travis Cluff, and Matthew Peterman would be solid recommendations for writers we should try to work with.

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Conclusions

1) Release dates in the summer, ideally early summer (June), are correlated with the best ROI.

2) Horror, mystery, and thriller genres are associated with the highest ROI.

3) Chris Lofing, Travis Cluff, and Matthew Peterman are writers associated with the highest ROI movies in the horror, mystery, and thriller genres.

Limitations

Even though we have a good amount of data covering a long time period, the rise of streaming movies is still a new development that will continue to change the way consumers watch movies and even what they watch. There are also societal changes that could cause preferences to evolve over time. We also had no information about marketing budget in this data, so that could make a difference as well.

Recommendations

1) We should work toward a goal of summer release dates, ideally in June.

2) Horror, mystery, and thriller genres are recommended.

3) Chris Lofing, Travis Cluff, and Matthew Peterman are writers we should try to work with.

Next Steps

1) This is an ever-evolving industry, so keeping tabs on this data and how it changes is essential.

2) It would be good to get some information about marketing budgets and to what extent marketing could help achieve an even better ROI for our movies.