The Relationship between Film Ratings and Global Box Office Gross

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Introduction

According to Motion Picture Association of America (MPAA), the global box office reached a new record high of $40.6 billion in 2017, which is up five percent from the previous year. "More than three-quarters (76%) of the U.S./Canada population aged two or older, or 263 million people, went to a movie at the cinema at least once in 2017 (moviegoer); The typical moviegoers bought 4.7 tickets per year in 2017" (Theatrical and Home Entertainment Market Environment Report, 2018).

On top of this, "the production and distribution of motion pictures is one of the nation's most valuable cultural and economic resources," according to "The Economic Contribution of the Motion Picture & Television Industry to the United States (The Report)." In 2016, the motion pictures industry supported 2.1 million jobs and generated $139 billion in total wages. "The industry contributed $134 billion in sales to the overall economy in 2016 (up 1% from 2015)" (The Report, 2018).

Film rating system has an important impact on film content creation. MPAA establishes guidelines for film content based on the Hays Code since 1968 and creates the film rating system we use today. Almost all films have to go through the Classification and Rating Administration (CARA), administrated by MPAA, so as to exhibit and distribute commercially to the public in the United States. Commercial films fall into five categories – G (all age admitted), PG (parental guidance suggested), PG-13 (parents strongly cautioned), R (under 17 requires accompanying parent or adult guardian), and NC-17 (above 17 only).

Many films are digitally edited so as to satisfy certain rating requirements. One famous example is *The King' Speech*, which was appealed to be an R rating. However, MPAA gave a PG-13 rating for removing 2 swear words, which made the film possible to release prior to the 83th Academy Rewards. Thanks to this timely rating, *The King' Speech* won 4 of its 12 nominations. Otherwise, *The King' Speech* would have to go through a 90-day withdrawal period and wait another year for the Awards (Finke, 2011).

We can tell how significant box office is to our economic growth and social issues, such as employment rate, and how important film rating system is to film industry. This paper will build a regression model to find out whether the number of a certain rating of films will affect annual box office gross or not. Based on the model, we could give the studios some useful suggestions about the content they create.

Literature Review

Since 1981, many research papers linked film rating and box office. Austin et al. (1981) focused on the annual success ratios (domestic rentals over $1 million in 1969 dollars), and concluded that "G and X … were 'box-office poison,' while M and R were helpful." We should notice that the rating system used from 1968 to 1970 were G (general audience), M (parental discretion

advised), R (restricted to 16 above unless accompanied by parent or adult guardian), and X (above 16 only), which are different from what we are using today.

Barry R. Litman published "Decision-Making in the Film Industry: The Influence of the TV Market" in 1983. Litman did not find MPAA ratings to be statistic significant to box office gross. One shortage of his model was that this paper was written before 1984, when PG-13 was implemented.

Later, Abraham Ravid found out that "a higher return on investment is correlated only with G or PG ratings and marginally with sequels" (1999). However, in their model, only PG films were a statistical significant variable to box office revenue, which p-value is around 0.01. Also, the data Ravid used was not global box office, but only the US market.

Daniel Ellis and Brooke Conaway used an Ordinary Least Squares regression model to suggest that "Motion Picture Association of America (MPAA) ratings … are positively associated with domestic box office film revenues" (2016). They used a random sample of 1635 films released between 2001 and 2012 to build the model. However, we should notice the fact that the average number of rated films between 2001 and 2012 was 362, of which, on average, 12 were G films, 51 were PG, 116 were PG-13, 182 were R, and only 1 was NC-17. We can notice that films within different rating categories were not equally distributed. The chances are that certain NC-17 and/or G films were overlooked in their model due to the small sample size they chose.

Empirical Model

Linear regression is used to estimate the relationship between film ratings and box office gross. In this paper, we estimate the following regression model:

$$gross = \beta_0 + \beta_1 gnum + \beta_2 pgnum + \beta_3 pg13num + \beta_4 rnum + \beta_5 nc17num + \beta_6 year + u.$$

In the model above, dependent variable gross measures the annual global box office gross in million dollars. Independent variable *gnum* measures the total number of G rating films each year; *pgnum* measures the total number of PG rating films each year; *pg13num* measures the total number of PG-13 rating films each year; *rnum* measures the total number of R rating films each year; *nc17num* measures the total number of NC-17 rating films each year. Also, we control year as a dummy variable to exclude the possiblility of perfect collinearity.

Data

The data was collected from *Box Office Mojo*, a website widely used within the film industry as a source of data, especially box office data. The data is available at https://www.boxofficemojo.com/yearly/?view2=mpaa&chart=mpaaindex&view=releasedate&p=.htm.

Dependent variable, *gross* (in million dollars), shows total gross of all movies released in a given year. In this study, we use total box office gross from 1990 to 2017. *Box Office Mojo* self-reports on their website that only MPAA rated movies are tracked.

Independent variables, *gnum, pgnum, pg13num, rnum,* and *nc17num*, measures the total number of specific category rating films, respectively G, PG, PG-13, R, and NC-17, in a given year.

We also include *year* as an independent variable because the total number of films in different years is not the same. Also, it is obvious that the number of films will have an impact on the total box office gross more or less.

We define *nyear* as a dummy variable, where *nyear* is equal to 1 if it is after the year of 2007. Box office gross had been influenced due to the fact that, in 2007, Netflix started streaming services. As John MacDougall suggested in his article, "Netflix Reshaping Global Entertainment Economy: Study," it is getting harder to persuade audience to watch movies in theaters (*The Hollywood Reporter*. 2018).

Table 1 below shows the summary of descriptive statistic variables.

Table 1. Descriptive Statistic Variables

```
. sum totalgross gnum pgnum pg13num rnum nc17num nyear
```

Variable	Obs	Mean	Std. Dev.	Min	Max
totalgross	28	8263.254	2352.698	4311.5	11272.3
gnum	28	9.964286	3.853638	4	19
pgnum	28	45.42857	10.85742	25	61
pg13num	28	96	30.04688	53	140
rnum	28	170.3571	30.26331	112	214
nc17num	28	1.107143	1.196887	0	4
nyear	28	.3571429	.48795	0	1

Table 1 above shows a wide variance in total box office gross in different years. Global box office gross varies from $4311.5 million in 1991 to $11272.3 million in 2016 with the average of $8263.254 million.

The number of G rating films shows a small variance, whose standard deviation is around 3.85. The number of G rating films varies from 4 in 2015 to 19 in 2002 with an average around 10 every year. The number of PG rating films varies from 25 in 1999 to 61 in 2007 with an average around 45 every year. The number of PG-13 and R rating films show a relative large variance. The number of PG-13 rating films varies from 53 in 1995 to 140 in 2008 with the average of 96 annually, and the number of R rating films varies from 112 in 1994 to 214 in 2013 with the average of 170 annually. There are very few NC-17 rating films from last 28 years. The number of NC-17 films is around 1 per year on average, and the max number of NC-17 rating films is 4 in 2004.

Table 2 below shows how we generated *nyear*, a dummy variable, from independent variable *year* in STATA. Dummy variable *nyear* is equal to 1 if it is after the year of 2007.

Table 2 Generate *nyear* as A Dummy Variable

```
. generate nyear= (year>2007)

. tabulate nyear, generate(g)
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nyear	Freq.	Percent	Cum.
0	18	64.29	64.29
1	10	35.71	100.00
Total	28	100.00	

Empirical model

Regression results in Table 3 below show that film rating is an important determinant of global box office gross.

The number of PG-13 and R rating films is positively related to the box office gross. One more PG-13 rating film will approximately increase box office gross by $42.63 million after 2007 (p-value<0.01). The number of PG-13 rating films is statistically significant at the 1% level. One more R rating film will increase box office gross by around $15.71 million after 2007 (p-value<0.10). The number of R rating films is statistically significant at the 10% level.

The regression results also show that more NC-17 rating films will potentially hurt global box office gross. One more NC-17 rating film will approximately decrease the global box office gross by $269.52 million after 2007 (p-value=0.10). The number of NC-17 rating films is statistically significant at the 10% level.

Table 3 Regression Results

```
. regress totalgross gnum pgnum pg13num rnum nc17num nyear
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Source	SS	df	MS	Number of obs	=	28
				F(6, 21)	=	40.42
Model	137539841	6	22923306.8	Prob > F	=	0.0000
Residual	11910202.4	21	567152.493	R-squared	=	0.9203
				Adj R-squared	=	0.8975
Total	149450043	27	5535186.79	Root MSE	=	753.1

totalgross	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
gnum	-24.21426	47.49012	-0.51	0.615	-122.9754	74.54685
pgnum	17.49352	17.91809	0.98	0.340	-19.76918	54.75622
pg13num	42.62838	11.83922	3.60	0.002	18.00738	67.24938
rnum	15.70614	8.542281	1.84	0.080	-2.058507	33.47078
nc17num	-269.5202	156.8622	-1.72	0.100	-595.7331	56.69273
nyear	1106.534	504.0017	2.20	0.040	58.40476	2154.663
_cons	845.055	1356.01	0.62	0.540	-1974.923	3665.033

This regress model shows that *nyear* is also an important determinant of global box office (p-value<0.05) as we expected. However, the regression results show that the global box office actually is higher after the year of 2007 than before the year of 2007, even if Netflix started streaming online. We assume that there are some other factors also affect global box office gross, such as the price per ticket, inflation and deflation in different countries, regions, and etc.

Although G rating films have a broader targeted audiences, they will actually hurt the global box office. One more G rating films will decrease global box office approximately $24.2 million. As for PG rating films, they have a positive impact on global box office gross. One more PG rating films will increase global box office gross by around $17.49 million. However, variables *gnum* (the number of G rating films) and *pgnum* (the number of PG rating films) are not statistically significant in this model (p-value>0.1).

Conclusions and Policy Implications

The empirical model shows that film rating is a significant determinant to box office gross. Statistically more PG-13 and R films will boost box office gross, while more NC-17 will hurt box office. The studios and independent filmmakers should produce more contents fall into PG-13 and R rating categories. They could have a better chance to be a blockbuster so as to earn more profits. Especially, the effect of PG-13 rating films is the strongest because of the largest coefficient and the smallest p-value.

This conclusion is consistent with Austin's paper published in 1981, where he stated that "G (general audience), and X (above 16 only) … were 'box-office poison,' while M (parental discretion advised) and R (restricted to 16 above unless accompanied by parent or adult guardian), were helpful."

However, this conclusion is opposite of Barry R. Litman's report and Abraham Ravid's regress model. Litman did not find MPAA ratings to be statistically significant to box office gross, however both PG-13 and R films are statistically significant to global box office gross in our model.

In Abraham Ravid's model, only the number of PG films was a statistically significant variable to domestic box office revenue, however, the number of PG films is not statistically significant to global box office in our model. This shows that different film rating criteria and different markets (domestic and global) should be considered when producing a film.

Daniel Ellis and Brooke Conaway used an Ordinary Least Squares regression model to suggest that "Motion Picture Association of America (MPAA) ratings … are positively associated with domestic box office film revenues" (2016). They found out that "a movie rated PG-13 will earn between $15M – $34M more than an R-rated movie, all else equal." This result is consist with ours, where *pg13num* is approximately $27 million more profitable than *rnum*.

Some limitations

There are also some limitations of this study. *Box Office Mojo* only collected box office of MPAA Rated Movies. However, great amount of released films were not being rated by MPAA. "In 2017, reports the MPAA, 563 movies were rated by the Classification and Ratings Administration ... Meanwhile, the number of films released in the domestic market rose 8 percent, to 777" (Cieply, 2018). In other words, over 200 films released in USA market did not go through MPAA rating system in the year of 2017 solely. Cieply also predicted that "978 movies will be released in 2020 (allowing for 8 percent annual growth), while only 453 will be rated (reflecting a 7 percent annual decline)" in his article, "Like Hayrides and Landlines, the Ratings System, for Many Films, Is History." We cannot overlook such a huge amount of films when analyzing global box office gross in the future.

Another limitation of this study is that we didn't include a variable that indicates the inflation and deflation in different years and in different countries. Inflation and deflation will also have influence on the price of movie tickets, which will affect the global box office directly.

Also, after making a comparison between our model and Ravid's model, we can notice that region is potentially also an important variable we should not overlook when analyzing the box office gross. Due to diverse tastes and various culture background, different film rating categories could have an impact on box office of different regions. This could help filmmakers from different regions to make decisions based on where they are trying to release their works.

Reference

Austin, Bruce A., Mark J. Nicolich, and Thomas Simonet. "M.P.A.A. Ratings and the Box Office: Some Tantalizing Statistics." *Film Quarterly (ARCHIVE)*, vol. 35, no. 2, 1981, pp. 28-30, 54. *ProQuest*, http://ezproxy.lib.utexas.edu/login?url=https://search.proquest.com/docview/835063726?accountid=7118.

Cieply, Michael. "Like Hayrides and Landlines, the Ratings System, for Many Films, Is History." *Deadline*, Deadline, 28 Apr. 2018. https://deadline.com/2018/04/mpaa-film-ratings-system-history-for-many-1202378819/.

Ellis, Daniel and Brooke Conaway. "Do MPAA Ratings Affect Box Office Revenues?" *Academy of Business Research Journal*, vol 1, pp.64-88, 2015. *ResearchGate.* https://www.researchgate.net/profile/Brooke_Conaway/publication/305800376_Do_MPAA_Ratings_Affect_Box_Office_Revenues/links/5821c5d908ae1e06ad248670.pdf

Finke, Nikki. "MPAA Gives Oscar Fave 'The King's Speech' PG-13 Rating for Removing 2 Swear Words." *Deadline*, Deadline, 25 Feb. 2011. www.deadline.com/2011/02/mpaa-gives-oscar-frontrunner-the-kings-speech-pg-13-rating-for-removing-two-swear-words-109121/.

Litman, Barry R. "Decision-Making in the Film Industry: The Influence of the TV Market." *Journal of Communication*, vol. 32, no. 3, 1982, pp. 33. *ProQuest*, http://ezproxy.lib.utexas.edu/login?url=https://search.proquest.com/docview/1302230221?accountid=7118.

MacDougall, John. "Netflix Reshaping Global Entertainment Economy: Study." *The Hollywood Reporter*, 5 Jun. 2018. https://www.hollywoodreporter.com/news/what-effect-is-netflix-having-hollywood-1117092.

MPAA. "The Economic Contribution of the Motion Picture & Television Industry to the United States." 2018. https://www.mpaa.org/wp-content/uploads/2018/03/MPAA-Industry-Economic-ContributionFactsheet_2016-FINAL-2.pdf

MPAA. "2017 Theatrical Home Entertainment Market Environment (THEME) Report." 2018. https://www.mpaa.org/research-docs/2017-theatrical-home-entertainment-market-environment-theme-report/

Ravid, S. Abraham. "Information, Blockbusters, and Stars: A Study of the Film Industry." *The Journal of Business*, vol. 72, no. 4, 1999, pp. 463–492, 1999. *JSTOR*, JSTOR, www.jstor.org/stable/10.1086/209624.