Disney Movies: When will Disney Release its Next Blockbuster Film?

Math IA

Robbie Nelson

004830-0048

Standley Lake High School

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In 1938, Walt Disney released Snow White and the Seven Dwarfs, the first ever full length animated film. Since then, Walt Disney Animation Studios has grown bigger and bigger, making countless films that will be remembered for years to come. They have taken massively innovative film companies under their broad wings, such as Pixar, Ghibli Studios, Marvel, Lucasfilm, and several other well known companies. The release of Frozen in 2013 created a cultural tsunami, quickly crushing box office records, raking up 13 awards for music and animation, and now becoming an integral part of the face of Disney. This type of success for Disney is not common place, but ever since Snow White and the Seven Dwarfs, Disney has produced several blockbuster type films, including One Hundred and One Dalmatians, Beauty and the Beast, Aladdin, and The Lion King.

Personally, I fully enjoyed Frozen and I cannot wait for Disney's next blockbuster. There are several different animated features lined up in theatres for Disney in the near future, but it seems impossible to know which will have success more success, and which will not be remembered. Within my research I want to try to predict the success of upcoming Disney movies, and decide when the next blockbuster film could come. Due to the massive size of The Walt Disney Company, I will be looking into movies produced specifically by Walt Disney Animation Studios (WDAS). I plan to look for trends in these films to decide when Disney will release its next popular movie.

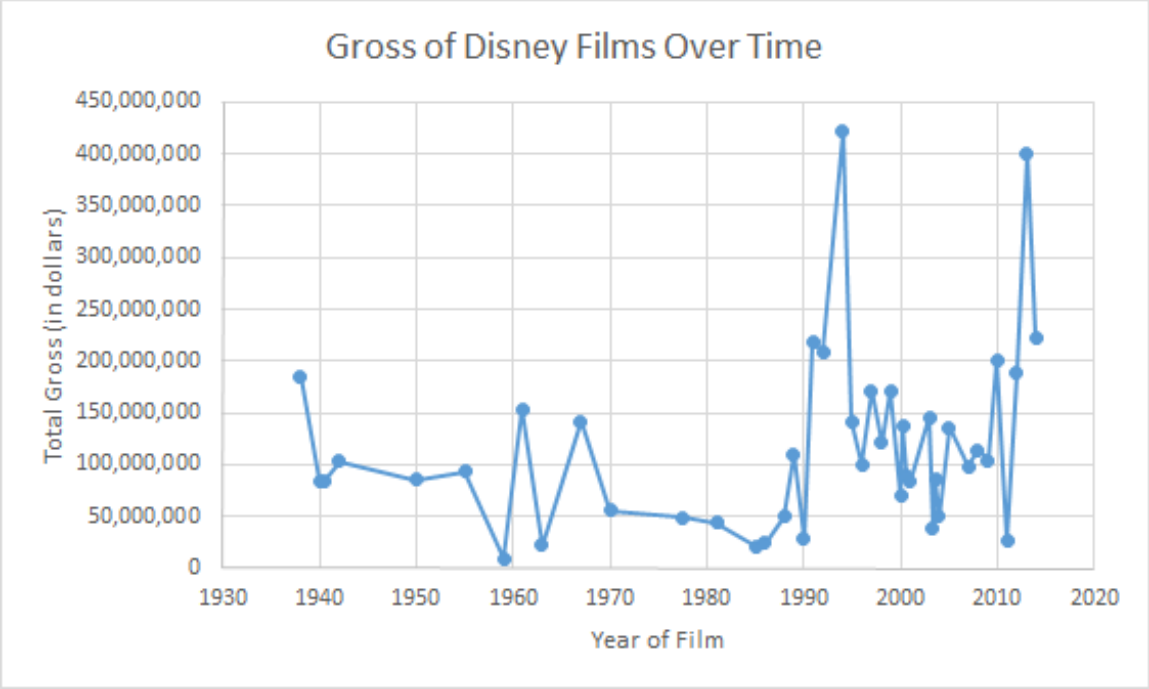
Searching For Trends in Disney Popularity

To start, I took a look into the total money made of most movies from WDAS in the box office. This data was taken from The Numbers, a website that displays box office statistics for all different types of films.

Movie Title	Year of Release	Total Gross
Snow White and the Seven Dwarfs	1938	184,925,485
Pinocchio	1940	84,300,000
Fantasia	1940	83,320,000
Bambi	1942	102,797,000
Cinderella	1950	85,000,000
Lady and the Tramp	1955	93,600,000
Sleeping Beauty	1959	9,464,608
One Hundred and One Dalmatians	1961	153,000,000
The Sword in the Stone	1963	22,182,353
The Jungle Book	1967	141,843,000
The Aristocats	1970	55,675,257
The Rescuers	1977	48,775,599
The Fox and the Hound	1981	43,899,231
The Black Cauldron	1985	21,288,692
The Great Mouse Detective	1986	23,605,534
Oliver & Company	1988	49,424,284
The Little Mermaid	1989	109,859,444
The Rescuers Down Under	1990	27,931,461
Beauty and the Beast	1991	218,951,625
Aladdin	1992	208,577,270
The Lion King	1994	422,780,140
Pocahontas	1995	141,567,679

Movie TItle	Year of Release	Total Gross
The Hunchback of Notre Dame	1996	100,117,603
Hercules	1997	171,091,819
Mulan	1998	120,618,403
Tarzan	1999	171,091,819
Fantasia 2000	2000	69,610,858
Dinosaur	2000	137,748,063
The Emperor's New Groove	2000	89,296,573
Atlantis: The Lost Empire	2001	84,052,762
Lilo and Stitch	2003	145,771,527
Treasure Planet	2003	38,120,554
Brother Bear	2003	85,336,277
Home on the Range	2004	50,026,353
Chicken Little	2005	135,386,665
Meet the Robinsons	2007	97,822,171
Bolt	2008	114,053,759
The Princess and the Frog	2009	104,400,899
Tangled	2010	200,821,936
Winnie The Pooh	2011	26,692,846
Wreck-It Ralph	2012	189,412,677
Frozen	2013	400,738,009
Big Hero 6	2014	222,527,828

Next, I used Microsoft Excel to begin to look into what the trends of these movies are. My initial graph looked like this.

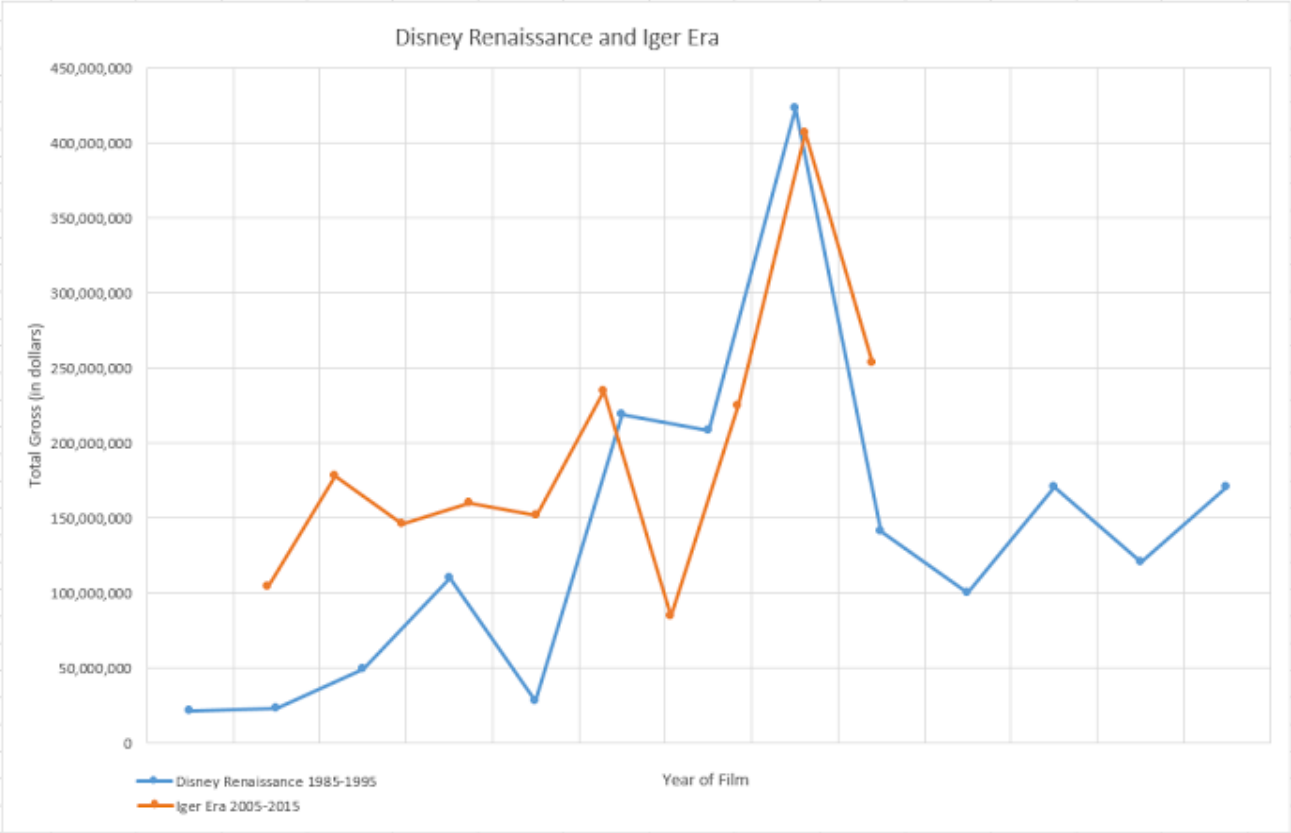


The highest points along the graph are Snow White and the Seven Dwarfs (1938), One Hundred and One Dalmatians (1961), The Jungle Book (1967) The Lion King (1994), and Frozen (2013). When I use the term "blockbuster" I mean to say that the film's gross rises substantially above other movies within 10 years before and after that film. Initially this graph doesn't show much of a trend at all. One important thing to notice is that each maximum seems to occur around 20 to 30 years apart.

Looking at Periods of Disney's Success

The particularly most interesting trends are the increase from around 1985 to 1995 and then again from about 2005 to 2015. Both seem to have increasingly more successful movies, upto their crown jewel of the era, usually including at least one "flop" of the era as well. Many fans and employees refer to the period from 1985 to 1995 as the Disney Renaissance, because of the public's renewed interest in Disney movies during this time. This can also be attributed to the new availability of movies, with VHS beginning to spread throughout the nation. Meanwhile, Bob Iger became the CEO in 2005, which began what is known by most as the Iger Era. This era

is, once again, characterized by heightened popularity of Disney movies, and the development of CGI (computer generated imagery) in movies. I took a closer look at these areas by plotting both eras on the same set of axes. I used a red line to represent the Iger Era and a blue line to represent the Disney Renaissance. Take note that each line took place in different time periods, which is why there is no x axis data.



In this graph, it's very easy to see the trend that seems to be followed. Movies like Beauty and the Beast (1991) and Aladdin (1992) correspond with Tangled (2010) and Wreck-It Ralph (2012), which act as the rising success before the Disney masterpiece of the era, which is The Lion King (1994) and Frozen (2013). It is also interesting to note that all but Wreck-It Ralph were musicals. The absolute minimum point in the Iger Era is the Winnie The Pooh reboot, which seems to be mirrored in the Disney Renaissance with The Rescuers Down Under, which was a sequel to The Rescuers, causing the local minimum towards the beginning of the period.

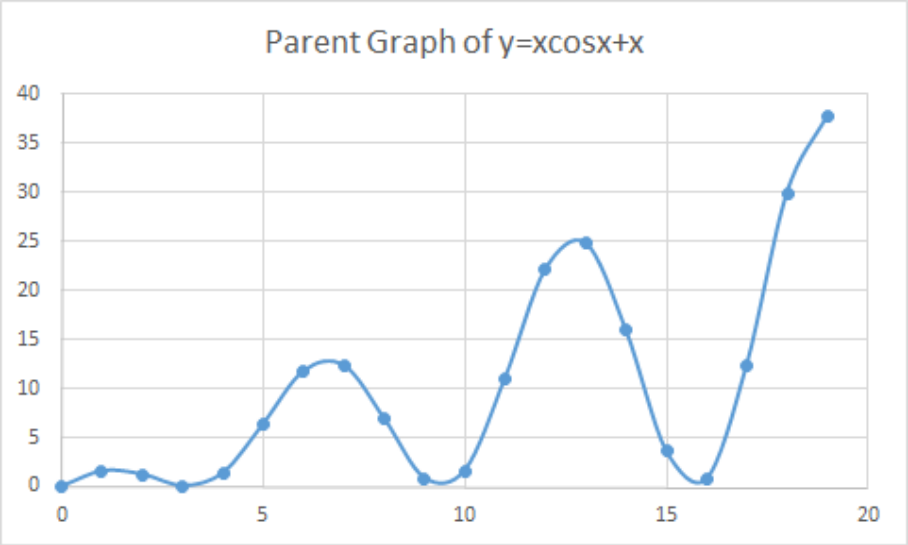
As I had noted before, there seems to be a cycle that lasts around 20 years. According to this data, we should expect to wait until around 2035.

Modeling Success of Disney Over Time

I wanted to use my original graph and produce a model that would show similar results as what I have just predicted. I knew that my graph would be a trigonometric function because there would include one blockbuster film every 20 years or so, reaching a peak exactly like a sine or cosine would. Our only exception would be near 1964, where it seems to be two more successful movies, but an absence of a real blockbuster. I wanted it to be slowly increasing, since the initial two more successful periods were significantly smaller than the more recent ones. I also knew that it could not go into the negative numbers, as there cannot be negative sales. I experimented with sine and cosine functions, knowing these requirements of my graph, and eventually decided on this parent equation:

This equation is useful because it will grow as the x variable increases, while maintaining my desired period trend that I had noticed. It will not sink into the negatives because of the added 1 in the parentheses, which raises the sinusoidal axis to avoid it becoming negative ever.

This equation will produce a graph looking like this:



Based on what I had required for the trend of the graph, this will work for the desired shape of my model. In order to fit it the way I want it to be, I used this equation:

This equation assumes that A is the rate of change of the altitude, B provides the period, which I will explain later, C is the horizontal shift, and D is the rate of change of the vertical shift of the function.

First of all I wanted to change the graph so that it would only create a peak about every 20 years. In fact, I took an average of the years between each blockbuster film (using an average between Jungle Book and One Hundred and One Dalmatians) and found the average time between each blockbuster to be 25 years.

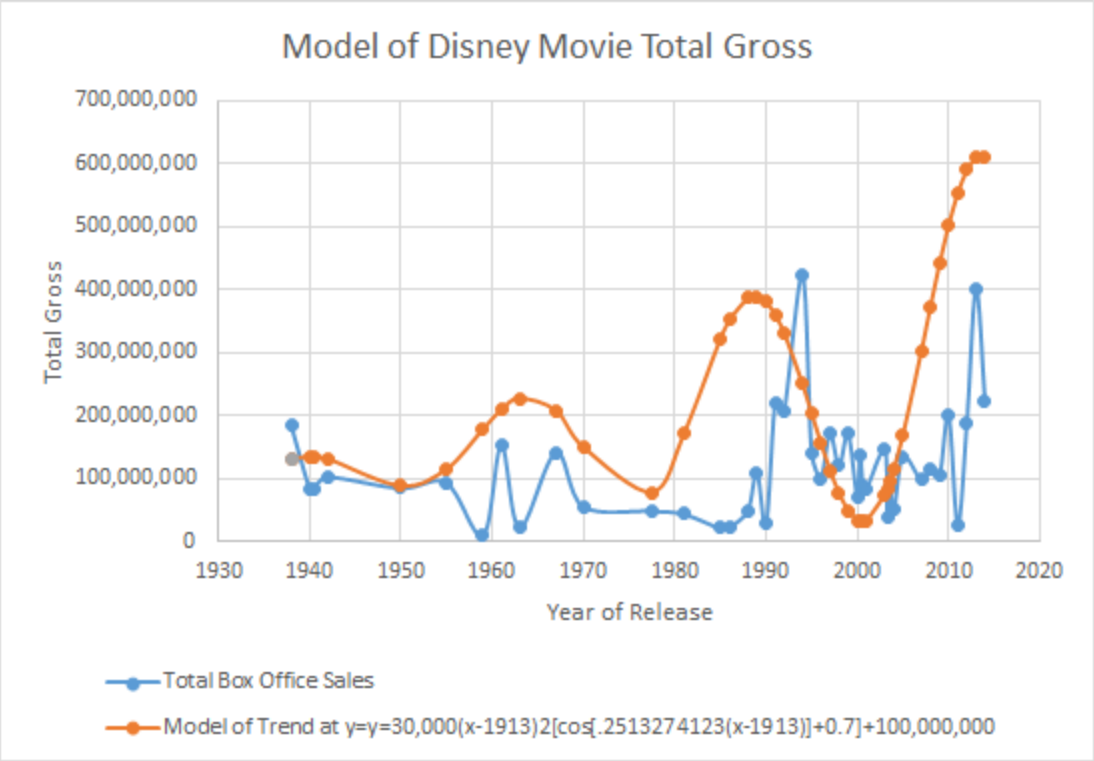
Then I found the B value, given a period of 25. B is related to the period such that the period is equivalent to. Thus, You can solve for B with a desired period.

This made my equation look like this:

Next, I wanted to assure that there would be a maximum at 1938, and I also wanted to move the equation so that it began at 1938, the release of Snow White, rather than having been increasing for 1938 years before getting to this data. Normally I would move the data back 1938 years, but I wanted there to be an actual maximum and decreasing slope after Snow White, so I only moved it back 1913 years, to allow exactly one period to pass before I began the data. Therefore, I changed my equation to look like this:

Then I wanted to set it equal to the size of the grossing films, which were in the millions. I raised it by 100,000,000, and only multiplied it by 30,000. This would allow the slopes to not be quite as radical while still providing a similar result. I squared the multiplier of the equation so that it would keep the initial values smaller and the final values slightly larger. I also reduced the 1 within the outermost bracket which would tilt the graph down to better match the results around 2000 that had lower totals than 90,000,000. This was my final result.

I then graphed this equation with my original points.



This equation seems to work fairly well! It seems to stay above the actual data predominantly, and the maximum around 1990 is slightly off because the period is 25 years and that specific period should be more like 30 years.

The biggest inaccuracy that I wanted to bring attention to is the overshot line around 2013, when Frozen was released. Why does it show that it is going to be so much higher than it did? Maybe I can find a solution to this, or some explanation to the gap between the assumed value and the actual value. After a bit of consideration, I realized that there could in fact be a considerable amount of distortion due to inflation of the US dollar over the past 100 years.

Adjusting for Inflation of Total Gross

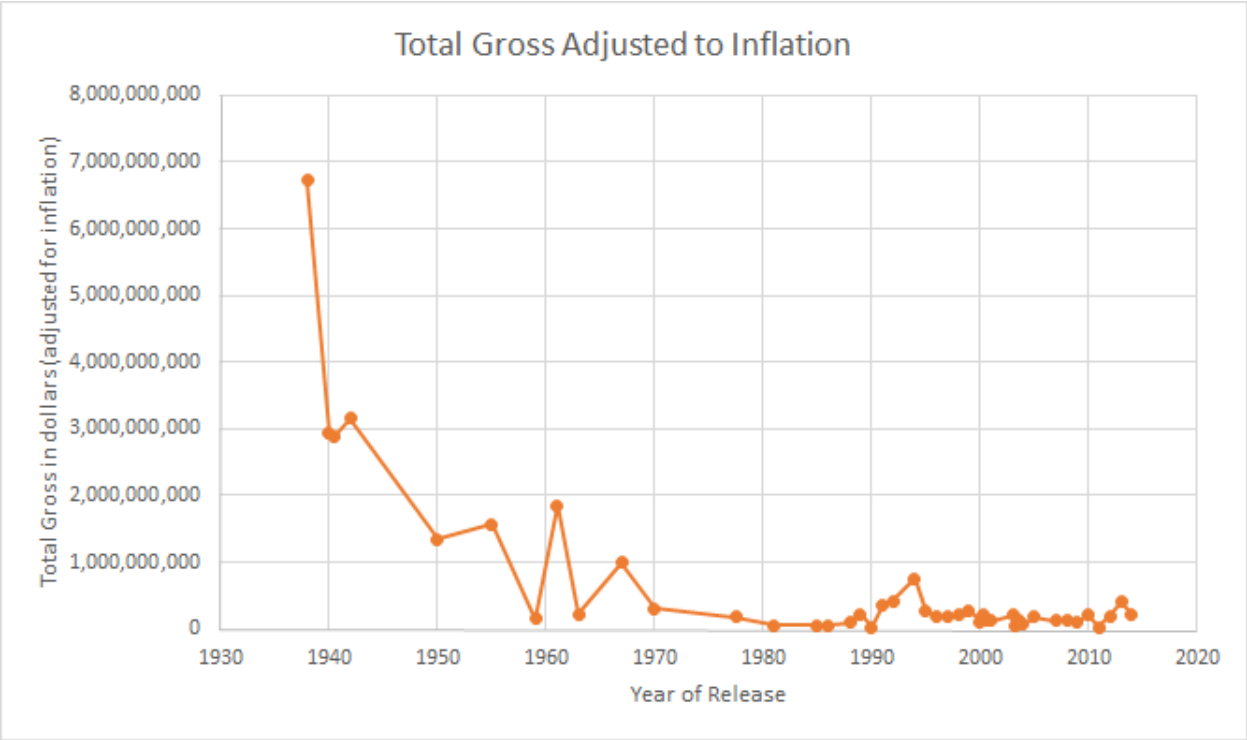
This is a list of total gross of films, adjusting to the worth of a 2016 US Dollar. I used published estimated values from The Numbers, a box office information website.

Movie Title	Year of Release	Total Gross
Snow White and the Seven Dwarfs	1938	6,729,679,608
Pinocchio	1940	2,927,763,484
Fantasia	1940	2,893,727,800
Bambi	1942	3,151,688,246
Cinderella	1950	1,347,443,178
Lady and the Tramp	1955	1,573,156,625
Sleeping Beauty	1959	155,330,920
One Hundred and One Dalmatians	1961	1,855,956,518
The Sword in the Stone	1963	218,430,936
The Jungle Book	1967	989,354,925
The Aristocats	1970	300,646,391
The Rescuers	1977	183,072,540
The Fox and the Hound	1981	53,485,237
The Black Cauldron	1985	50,193,342
The Great Mouse Detective	1986	53,255,615
Oliver & Company	1988	101,216,376
The Little Mermaid	1989	218,601,006
The Rescuers Down Under	1990	27,931,461
Beauty and the Beast	1991	360,973,735
Aladdin	1992	421,129,628
The Lion King	1994	756,219,975
Pocahontas	1995	272,394,870

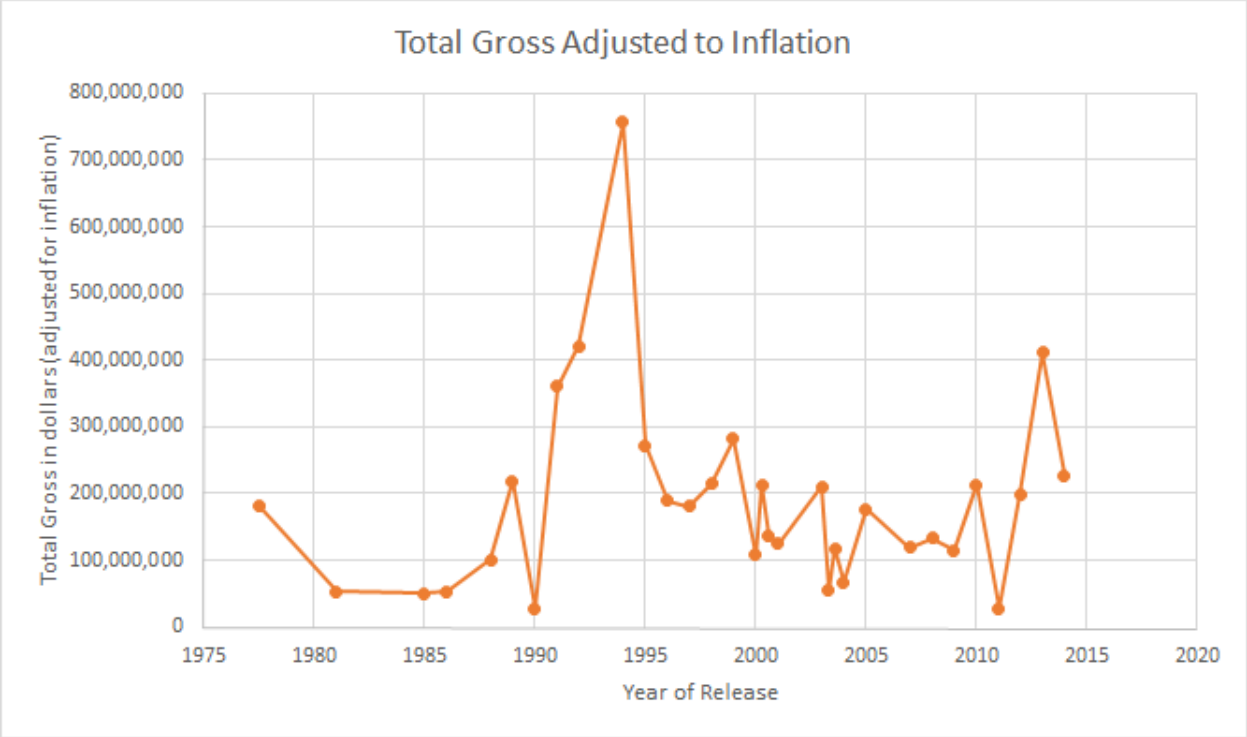
Movie TItle	Year of Release	Total Gross
The Hunchback of Notre Dame	1996	189,569,996
Hercules	1997	180,614,740
Mulan	1998	215,261,418
Tarzan	1999	281,869,317
Fantasia 2000	2000	108,313,835
Dinosaur	2000	213,905,620
The Emperor's New Groove	2000	135,804,740
Atlantis: The Lost Empire	2001	124,297,103
Lilo and Stitch	2003	210,001,325
Treasure Planet	2003	54,640,189
Brother Bear	2003	118,360,337
Home on the Range	2004	67,426,820
Chicken Little	2005	176,690,432
Meet the Robinsons	2007	119,006,150
Bolt	2008	132,751,071
The Princess and the Frog	2009	115,488,582
Tangled	2010	212,862,651
Winnie The Pooh	2011	28,173,905
Wreck-It Ralph	2012	198,928,945
Frozen	2013	412,043,457
Big Hero 6	2014	227,698,124

I can immediately notice that Snow White and the Seven Dwarfs has made a huge change, from 184 million dollars to nearly 7 billion dollars. Snow White and the Seven Dwarfs was a

legendary film in it's time because no one had ever seen a full length animation before, and it was released just during the tip end before the economic boom of wartime preparations in the US, allowing anyone to go see it. I checked the graph to see the actual shape.



This graph is looking more like a rational function than anything, and seems to show a dark future for Disney, eventually reaching 0 dollars of total gross. I decided to toss out some of the oldest data to better see the more recent points. Instead I began in 1977 with The Rescuers. This was the result.



This shows us a very interesting perspective, because rather than focusing on the fiscal success of the movie, it is very focused on the actual popularity of the movie. The maximum value at 1994 is, once again, The Lion King. The other maximum at 2013 is Frozen as well. However, this time, Frozen seems only half as successful as The Lion King. What does this mean? Frozen seems to align more closely with Aladdin (1992). Let's assume that the Disney Renaissance and the Iger Era could indeed be related.

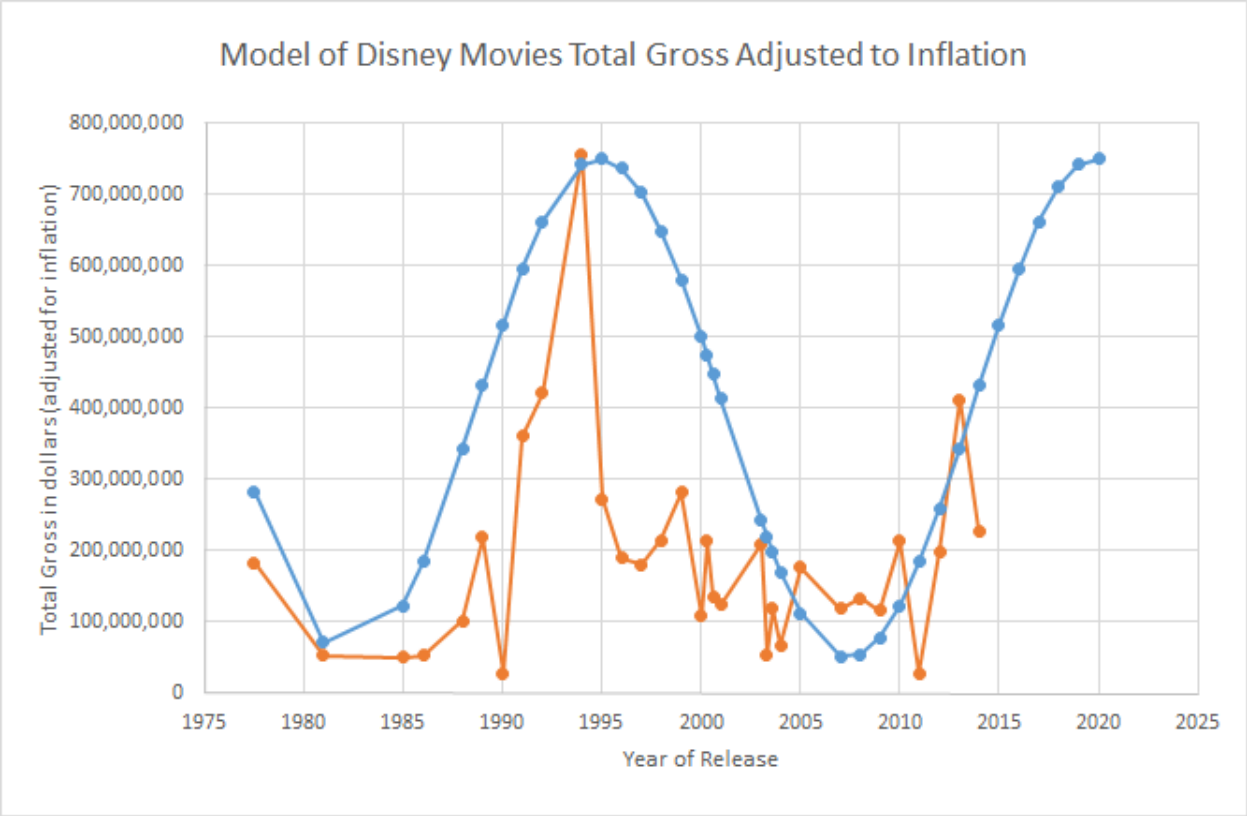
Modeling the Adjusted Data Using a Trigonometric Function

I wanted to find what this means for the future of Disney, so I'm now using a cosine graph to model it. I started with a simple parent function:

Then, I added 400,000,000 to raise it so that the function would be anchored around that point. I also multiplied by 350,000,000 so that it would go from about $750,000,000 to around

$50,000,000. Once again, I also multiplied the argument by 0.2513274123, to keep the period at about 25 years. Finally, I subtracted 4.5 from the argument to align the maximum of the model to the maximum of the data. I had no need to push the graph forward or backward since this function is simply a repeating one. This is my final equation.

This was the resulting graph.



I find this extremely interesting because this shows a very different result about the next blockbuster film of Disney. Frozen is a mere stepping stone up to the masterpiece film of the Iger Era. Rather than 2035, this data seems to show that the blockbuster equivalent to The Lion King will be approaching within the next five years, potentially close to 2019!

Reflecting on this Exploration

Within this exploration I was able to make a prediction upon future events by looking at algorithms and trends in Disney box office history. However, my exploration was no where near complete, as it is impossible to easily predict the future trends. This is particularly the case when there are so many unaccounted-for variables. The Walt Disney Company could easily be planning their next blockbuster film, and because of their control, they could easily wait to release such a film to any degree of years that they choose. Also, the public's response to a film is usually impossible to predict by a trend line.

Even still, with consideration to factors like this, other sources of profit from a movie were unaccounted for, such as the DVD sales, or merchandise, or rentals on Netflix. For example, some movies may have had initial failures in the box office, but over time have been redeemed as "Classic" Disney films.

However, I was able to take a bit of data about the success of Disney movies to predict the next potential time for the next blockbuster film, and end in a rough estimate of when that will be: 2019.