Black Panther vs The Help, the battle of inclusion versus tokenism:

A comprehensive examination of underrepresentation of ethnic minorities in Hollywood films

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Management summary

In recent years, the issue of minority representation in Hollywood films has become increasingly prominent. Countless studies have been published on this topic, and there is a growing demand for clarity about the relationship between representation and its effects.

This paper addresses the pressing issue of diversity and representation within the film industry, specifically focusing on Hollywood films. Films are powerful cultural influencers that shape societal beliefs. The lack of representation in films can perpetuate negative stereotypes and marginalization, which can have a harmful impact on individuals and communities. The study highlights that films with diverse casts tend to perform better at the box office due to their wider appeal. This suggests that diversity is not only a moral imperative, but also a financial necessity. The study highlights the economic significance of the film industry, which generates billions of dollars in annual revenue and produces some of the most profitable products in the world.

Despite recent improvements in representation, the study underscores that existing measures often overlook the nuances of representation and the need for authentic inclusive representation (AIR). AIR is a comprehensive approach to representation that accounts for effective representation rather than mere tokenism. The study argues that AIR is essential for creating films that resonate with diverse audiences and positively impact society.

Preface

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# Introduction

## Problem Indication

The film industry is a major part of our global economy. Films generate nearly $100 billion annually through theaters and home channels. Moreover, the economic impact is evident in successful products. For instance, Disney's "The Force Awakens" earned a net profit of $780 million (MPA, 2022), displaying that films are a serious, high-return industry despite their light-hearted nature. Furthermore films do not only hold economic significance, they are related to cultural aspects of society.

Films are not only a form of entertainment, they reflect and shape the cultural context in which they are created. They mirror societal values, attitudes, and perspectives and can effectively convey ideas, emotions, and perspectives through their visual and narrative nature. As a result, they have the potential to shape how people perceive the world and the cultures around them (Belton, 1995).

In today's increasingly diverse and socially conscious world, this responsibility currently translates that the Hollywood film industry is under increasing pressure to be socially conscious and to address issues of representation, particularly in relation to gender and people of color (Sperling, 2021). The common consensus is that representation in films is important because it counteracts narrow viewpoints regarding groups depicted in the media, which can reinforce negative stereotypes and biases that result in discrimination and marginalization (The Annenberg Foundation, 2018; Castañeda, 2015; Ross, 2019; Kubrak, 2020; Buchanan, 2005).

Moreover, representation in films is not only important for social factors, studies show films with diverse casts appeal to broader audiences and perform better at the box office (Annenberg Foundation, 2018). For example, a 2018 study by the University of Southern California found that films with diverse casts were 1.4 times more likely to be seen by broader audiences. Additionally, a 2021 McKinsey and Company study found that films with casts which consisted of at least 30% minority were 1.3 times more likely to be profitable. By prioritizing diversity and representation, filmmakers can create more inclusive and authentic stories, attract larger audiences, and boost their bottom line (Whitten, 2019; Bunche, 2018; Reporter, 2021). This suggests that racial diversity is both a moral and financial imperative for the film industry.

Efforts to increase diversity and representation in film have led to a significant increase in the proportion of films featuring minority actors. For example, UCLA data shows that between 2011 and 2021, the percentage of films with predominantly minority casts increased from 2% to 32.1%.

Nevertheless, the public, media, and most studies adopt a narrow approach measuring diversity (Malik, 2022). Most studies do not make a distinction between different minority groups and measure diversity based on the share of minorities in the cast. Additionally, some studies focus solely on one minority group. This narrow approach has caused two major issues.

Firstly, the approach of treating minority groups as a homogenous unit has resulted in uneven representation across the different minority groups. For instance, while African-Americans have been overrepresented in films for the past three consecutive years and the Asian community is ‘rightfully’ represented, the Latin community remains severely underrepresented, with 6.8 % of the actors and actresses being Hispanic compared to an actual population of 20% in the United States. (UCLA, 2021; MPAA, 2021). As a result, this group still experiences the social consequences of being underrepresented.

Secondly, while measuring diversity based solely on minority share is a useful first step, it fails to capture important information about the nature of the representation. (Malik, 2022; Lazar, 2020) To effectively address the social dimension of diversity, authentic inclusive representation (AIR) is essential. (Lazar, 2020; Roughton, 2014) This means that films must avoid tokenism and create meaningful storylines for characters from diverse backgrounds. (Lazar, 2020)

Building on this perspective previous studies such as Kuppuswamy and Younkin (2016) and Weaver (2011) have fallen short of conducting a comprehensive analysis of the effects of racial diversity. Therefore, while emphasizing diversity in the cast is a positive step towards showcasing racial diversity, AIR is an additional factor that warrants consideration for racial diversity analysis.

Finally, as discussed racial representation in film is a social construct. Nevertheless, most studies use box office revenue as the dependent variable to analyze a film’s success (Malik, 2022; Kuppuswamy, 2016; Madongo, 2023). While box office revenue is a useful measure of commercial success, it does not necessarily reflect the quality of a film or its impact on audiences, as it is highly influenced by marketing , advertising and hype (Eliashberg, 2014; Clement, 2014). Therefore, this study will choose long-term audience engagement (LTAE) as dependent variable. As discussed later this concept entails both social and economical constructs which makes it a better measurement for a film’s success in the context of a social concept such as racial representation.

## Problem Statement

Following the problem background this studies problem statement is formulated as follows: “*What is the relationship between racial diversity in Hollywood films and LTAE, and to what extent does the presence of AIR mediate this relationship?”*

## Academic Contribution

Previous studies on racial diversity in films have taken a narrow approach, either by focusing on only one or two ethnic groups (Patel, 2015; Hall, 2020; Dixon, 2000 ; Kuppuswamy , 2016) or by grouping all minority groups together (Aumer, 2017). This study addresses these limitations by including multiple minority groups and distinguishing between them. This is important because different minority groups have different experiences and perspectives, and their representation in films should be considered separately. Moreover, analyzing the minority groups with this approach improves the generalization of the results.

Second, as noted by Malik (2021, p. 1), 'there are no clearly defined, standardized, and scalable metrics for taking stock of racial minorities’ cinematographic representation'. Previous studies such as Weitzman et al. (1972) and Smith et al. (2013) have used manual annotation, which produces high-quality insights, but is time-consuming and expensive. This study builds on prior research on gender biases in film (Agarwal et al., 2015; Kagan et al., 2020), and seeks to standardize the concept of authentic inclusive representation (AIR) using the Bechdel-Wallace test (1985).

The Bechdel test, though not novel in its application to racial representation, was used in 2020 when the UCLA Center for Scholars & Storytellers introduced the REM test. However, the REM test lacks automation and fails to distinguish between different minority groups. By combining the work of previous researchers, this study aims to be as inclusive as possible while keeping the automated nature in its approach making it easily applicable to a large number of films.

Third, as mentioned before by using Long-term audience engagement (LTAE), this study uses a more comprehensive measure of success, as it takes into account factors such as word-of-mouth, social media engagement, and re-watching. This contributes to existing literature because it provides a more nuanced understanding of how audiences are engaging with films with diverse casts. Moreover, this causes that this study in contrast to other studies identifies films that are having a lasting impact on audiences, even if they may not have been box office blockbusters.

Using this approach, this study builds upon previous research and provides a more comprehensive and in-depth analysis of the relationship between representation and long term audience engagement in films.

## Managerial Contribution

This study offers valuable insights for filmmakers, studios, and stakeholders, helping them make informed decisions that can significantly impact a film's success in both financial and cultural terms. This research will show if intentionally casting diverse roles and developing characters which authentically represent a variety of backgrounds can potentially attract a wider audience, which can boost a film's financial performance.

As the film industry transforms, the traditional reliance on box office revenue diminishes as streaming services surge. Consequently, the industry landscape likely evolves towards a reduced focus on short-term gains, signaling a more prominent role for long-term success. While this study does not delve deeply into whether Long-Term Audience Engagement (LTAE) is a superior metric for long-term financial success, it demonstrates its potential as a viable measure. Thus, it provides film studios and creators with an additional metric to evaluate the success of their films, acknowledging the industry's shift towards a more comprehensive assessment of sustained impact.

Finally, if this study offers evidence indicating a preference for racially diverse films. It is highly probable heterogeneity in this preference exists among people. Establishing a general preference for racial diversity would pave the way for future research to explore individual differences in this preference. The findings from these studies could inform the development of movie recommendation systems.

## Structure of the Thesis

To address the research questions stated earlier, a quantitative research approach was employed in this study. This paper will first present a theoretical framework to contextualize the research, followed by a detailed description of the research methodology. Afterwards it will be discussed how the data collection and processing went. Finally, the results will be discussed.

# Literature Review and Hypotheses

This literature review delves into the current existing literature on the relationship between racial diversity in Hollywood films and LTAE. To provide clarity before delving into the relationships we first define LTAE and racial representation, and discuss the importance of AIR in the latter.

## Long-Term Audience Engagement (LTAE)

Audience engagement is a complex and multifaceted concept that encompasses the active involvement of an audience. In this study, the focus is on long-term audience engagement (LTAE), which goes beyond passive consumption and encompasses factors such as word-of-mouth, cultural impact, and sustained interest over time (Broersma, 2019; Kumar, 2022).

Before delving into the social attribute of LTAE it is important to clarify that LTAE has financial purposes. Similar to box office revenue LTAE is correlated with ancillary revenues such as engrossed viewing, longevity in distribution channels, and the purchase of film-related merchandise (Kumar, 2022). These factors demonstrate a persistent connection between the film and its audience, extending beyond the initial screening. This correlation between LTAE and revenue highlights its significance, surpassing box office revenue as a comprehensive measure of film performance. The social dimensions of LTAE will be explored in detail in the following paragraphs.

LTAE is a key factor in the media's capacity to shape attitudes, beliefs, and behaviors. It allows for a deeper and more sustained connection between the audience and the film, which can have a lasting impact on their lives (Tan, 2018). The effect of LTAE and changing behavior is demonstrated by Bard research in 2006, which discovered that individuals highly interested in violent video games for a longer period of time were more prone to displaying heightened levels of aggressive behavior, aggressive cognitions, feelings of anger, and physiological arousal.

Furthermore, the effects of long term engagement with media and changing our beliefs was displayed by Mastro et al. in 2007 which found that white people who were constantly exposed to negative racial stereotypes in the media were more likely to hold those stereotypes themselves. This was especially true for white people who don't have much real-life contact with people of color. When we're constantly exposed with negative portrayals of certain groups of people, it is hard not to start believing them. Therefore, the importance of racial representation in media will be discussed in the following paragraph.

## Racial Representation in Films

Representation of minorities in films pertains to the presence and portrayal of characters from minority groups, including people of color, people with disabilities, LGBTQ+ individuals, and other marginalized groups (Buckingham, 2008). Representation is essential because it allows people from different groups to see themselves on screen, which can lead to a greater sense of inclusion, empowerment, and validation (Annenberg Foundation., 2018; Dixon, 2000).

In contrast, the absence of representation has negative impacts on self-worth, as individuals from underrepresented groups do not see themselves or their experiences reflected in mainstream media (Castañeda, 2015; Ross, 2019; Kubrak, 2020; Buchanan, 2005). The spread of positive and accurate portrayals in the media is therefore essential for people to explore their identities with regards to race.

Racial identity is a complex concept that is constantly evolving. This study uses the defintion of Umaña-Taylor AJ, (2014 p. 3) which defines racial identity as “a multidimensional psychological construct that reflects the beliefs and attitudes that individuals have about their ethnic group memberships”. The four ethnicities discussed in this study are Black, Hispanic, White and Asian.

Our racial identity is not solely a product of our own perspective but is also shaped by how others perceive us. In multicultural societies, building positive relationships among diverse groups presents a significant challenge. In densely populated areas characterized by ethnic segregation, individuals often encounter other cultures and ethnicities solely through media portrayals (Kidd, 2015).Therefore, the powerful impact of media representations on shaping perceptions cannot be underestimated.

Positive depictions of communities of color can diminish feelings of threat and social distance among white audiences (Dalisay and Tan, 2009; Ortiz and Harwood, 2007), whereas negative portrayals, such as associations with criminality, can exacerbate negative stereotypes and widen divisions among ethnic groups (Abraham and Appiah, 2006; Hurley et al., 2015).

Further in this study the ongoing debate regarding the extent to which films should mirror the diversity of the real world will be discussed. Ultimately, filmmakers must understand the potential impact their creative choices can exert on viewers. Moreover, as highlighted in the next few paragraphs for filmmakers to understand how to represent ethnic minorities in a successful manner is as equally important.

## Authentic Inclusive Representation (AIR) in Racial Representation

The representation of minority groups in films takes on various forms. Some films and studies focus on the experiences of minority characters, while others simply include them as part of a larger cast (Malik, 2021). Nevertheless, overlooking authenticity in representation can result in films being mistakenly categorized as racially diverse while still perpetuating stereotypes and contributing to marginalization. As discussed previously these stereotypes in the film can perpetuate biases and misconceptions about minority groups (Umaña-Taylor AJ, 2014; Abraham and Appiah, 2006; Hurley et al., 2015) . Therefore, the concept of Authentic Inclusive Representation (AIR) emerges as a crucial element in racial representation.

The pursuit of authenticity in the representation of minorities in films is not a recent development. In 2014, Ralph Roughton stressed that genuine understanding and empathy, free from stereotypes, are key to changing attitudes. Effective representation requires viewers to truly understand and empathize with characters. (Roughton, 2014). AIR, as a concept, describes how accurately and respectfully a film portrays underrepresented groups in a nuanced manner.

Quantifying the concept of representation in films has resulted in researchers using the Bechdel-Wallace test (1985), originally designed to measure the authentic representation of women in a film (Agarwal, 2015). Notably, Lazar et al. expanded the application of this test to assess ethnic representation in films in 2020. The test comprises three gradations:

(T1) A film must feature a minimum of two named ethnic minority characters.

(T2) Two ethnic minority characters must engage in a conversation.

(T3) This conversation must not revolve around or include a white character.

An example for such a conversation would be a conversation between the main character and his wife in the film ‘12 years a slave’ :

**ANNE**

Solomon...

**SOLOMON**

Come, Anne. Jump.

**ANNE**

I will not ruin my dress. Catch me!

**SOLOMON**

I will catch you, Anne. I will.

**ANNE**

You will.

Even though the conversation is not very thorough or meaningful, it is between two named African American characters, and no white people are present or mentioned in the conversation. Therefore, this film would have AIR with regards to the test created by Lazar et al. With an understanding of the concepts, the following paragraphs will explain the relationships between one another.

## The Relationship of Racial Diversity and Long-Term Audience Engagement (LTAE)

The power of storytelling lies in its ability to create connections between viewers and characters who possess relatable qualities and admirable traits (Murray, 1999; Appiah, 2001; Hall, 2020). This connection is strengthened when there are similarities in demographic factors such as ethnicity, age, and gender, creating a sense of affinity between viewers and the on-screen portrayals (Hall, 2020).

As a result, when individuals see themselves or their own experiences represented in a story, they are more likely to form a strong emotional bond and become engaged with the film and its characters (Murray, 1999; Appiah, 2001; Hall, 2020). This suggests that when a film embraces racial diversity, it has the potential to attract a broader audience and foster greater overall LTAE (USC Annenberg, 2018).

Nevertheless, the demand for greater racial diversity in film is not universally embraced. A study by King (2020) identifies a group while not opposing racial representation in film, prioritizes the quality of the storyline. Arguing that when minorities are introduced without developed characters it influences the quality of the storyline. An effect discussed more in detail in the next section of this paper.

Patel (2015) argues that efforts to increase racial diversity have faced criticism, particularly from those who fear change and the increased visibility of people of color due to a persistent culture of colonialism or systematic racism. This idea of preference has led to the industry's practice of whitewashing, which is based on the assumption that white majority audiences prefer racially homogeneous casts and that diversity would not positively impact LTAE (Weaver, 2011).

The assumption that white majority audiences prefer racially homogeneous casts is believed to have led to studios allocating smaller budgets to projects with higher racial diversity. This assumption is supported by research by Smith et al. (2020), which found that films featuring racial minorities in lead roles often receive significantly less production budget. It is important to note that lower production budgets are a significant predictor of lower box-office sales (Eliashberg, 2014; Michel Clement, 2014), which can make it difficult to assess the true potential appeal of diverse films.

Nevertheless, it is essential to emphasize that the preference for whitewashing doesn't hold true for all scenarios (Aumer, 2017). Recent studies have also raised doubts about the idea that white actors are necessary for financially success of films (Chow, 2016). The prevalence of whitewashing may be more a product of industry habit than an accurate reflection of audience preferences. Nonetheless, due to the underfunding of diverse films, accurately assessing their potential appeal to audiences becomes a challenging task.

Furthermore, Teresa Correa's study in 2011 delved into the connection between racial diversity and social media engagement, revealing that minority groups tend to be more prolific creators of online content. This heightened interaction between minority communities and media is further evidenced by the active involvement of African-American and Latin communities in both traditional and digital entertainment, surpassing their proportional representation in the U.S. population (Gonzalez, 2014; MPAA, 2014).

This trend is likely to become even more impactful in the future as minority groups continue to grow as a percentage of the total U.S. population (Desilver, 2015). When a film successfully resonates with these audiences through representation, it is more likely to stimulate online discussions, which can lead to higher LTAE (Kumar, 2022).

Finally, it is argued that diverse casts can better reflect the diversity of the real world, which can help viewers to connect with the characters and the story (USC Annenberg, 2018). Despite the challenges posed by current industry forces and tokenism (which will be discussed in the next paragraph), the general consensus is that increased racial diversity in films has a positive impact on LTAE. Based on these considerations, the following hypothesis is proposed:  
**H1:** Increased racial diversity has a positive influence on LTAE.

## The Relationship Between Diversity and LTAE with AIR as Mediator

Including diverse characters in films is not without its challenges. One concern is tokenism, which occurs when underrepresented characters are introduced without fully developed storylines. This can lead to backlash and damage LTAE if viewers perceive the diversity as being insincere , which can ultimately affect the perceived quality of the film (Smith, 2016). For example, when minorities are introduced through tokenism, it can create the perception of a "racial agenda," which is often disliked by viewers (King, 2020).

Moreover, negative stereotypes are seen as a gross misrepresentation by balanced critics who advocate for avoiding films with stereotyping regardless of representation. Since critic reception plays a crucial role in shaping LTAE, misrepresentation is likely to lead to a decline in LTAE (Hofmann, 2016; Ghiassi, 2017; Kuppuswamy, 2016; Kumar et al., 2022).

Furthermore, these negative depictions can cause minority groups to disengage completely from the media. For example, a study by El Hazzouri (2019) found that ethnic minorities who saw public health ads featuring people from their own ethnic group were less likely to follow the advice in the ads than those who saw ads featuring white people. The authors explained this by saying that minorities felt like they were being negatively stereotyped by the advertisers.

In contrast AIR can have a positive effect if done correctly. According to research, large-budget films in 2021 performed better when they had more racial authentic representation (Lazar, 2020). The study emphasizes that racial representation must be authentic in order to foster empathy, understanding, and connection among viewers. There is an intuitive belief that racial diversity leads to authentic inclusive representation (AIR). The rationale behind this notion is straightforward. The more people from different ethnicity are included, the more likely it is that one of them will provide an authentic representation for that ethnicity.

Moreover, others argue that diversity encompasses a variety of perspectives and experiences, which can enhance authenticity of characters. This is because diverse casts can help to challenge stereotypes and assumptions about different cultures. As a result, they can help to create more nuanced and complex representations of people from different backgrounds (Smith, 2020).

Furthermore, there is a growing body of research that suggests that authentic representation of diverse individuals on screen, free from stereotypes, has a profound educational and socially engaging impact on audiences (Bamford, 2018). This transfers to all types of media, as shown by a study by Roberts, (2021) which found that news stories that portrayed diverse cultures and identities in an authentic way were more likely to foster empathy and understanding among readers. This is likely because seeing oneself and one's own experiences reflected in the media can lead to a deeper emotional connection with the characters and the story, making the media more engaging. Therefore, the hypothesis will be the following:

**H2:** The relationship between racial diversity and LTAE is mediated through AIR.

## Conceptual framework

A white rectangular sign with black text

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Figure 1 Conceptual model paper

Figure 1 indicates the conceptual model consists of three relationships. AIR being the mediator of the relationship between diversity and LTAE. As shown in the figure all relationships should be positive. These relationships will be examined through regressions models. The model specification can be found in the next section.

# Research Methodology

This study aims to investigate the relationship between racial diversity and Long-Term Audience Engagement (LTAE) in films, mediated by Authentic and Inclusive Representation (AIR). AIR is defined as the creation of characters and narratives that genuinely reflect the experiences and perspectives of marginalized groups. Being subjective from nature the Bechdel Test was used to quantify this concept.

The following sections will provide a detailed overview of the data collection and sampling procedures, as well as a clear operationalization of the variables, including AIR. Notably, AIR will be discussed across three distinct levels, as defined by the Bechdel test, which was discussed in the literature.

## Data sources

*Film characteristics*: I collected data on film characteristics from three trusted sources: IMDb, The Numbers, and The Movie Database (TMDB). These platforms have millions of registered users, ensuring credibility and diverse perspectives (Ghiassi, 2017).

*LTAE:* IMDB will be used to measure LTAE. The dependent variable of this study is rooted in IMDb user behavior which would be clarified in the operationalization. To ensure the generalizability of the findings, I compared demographic data on IMDb users to filmgoers.

While IMDb users and the general moviegoing population differ somewhat[[1]](#footnote-1), previous research suggests that IMDb's demographics are representative of the broader filmgoing audience (Ghiassi, 2017; Partha and Chakraborty, 2019; Apala, 2013). Therefore, given its large user base and diverse perspectives, I assumed that IMDb data is reliable for producing generalizable and accurate findings.

*Ethnicity determination:* I used the Kairos API, a deep learning algorithm that can detect ethnicity through facial recognition, to determine the ethnicity of actors and actresses in the films that were studied. I collected the profile pictures of the actors and actresses with a scraper from IMDb.

*AIR determination*: The Bechdel test is an ideal tool for measuring AIR in films because of its adaptability to our specific focus (Lazar, 2020), its potential for automation, and its quantifiability (Argarwal, 2015).

Previous research used to conduct the Bechdel test to determine the level of AIR in films (Argawal, 2015). However, film scripts can be changed during production, so they may not match the final film. Therefore, I decided to take a different approach and use subtitles for the hearing impaired. Subtitles represent the final version of the film's dialogue, capturing it exactly as it appears in the film. By using the subtitles.org API I was able to find subtitles for half of the films which were in a format that could be standardized for testing. I will discuss subtitle processing in the operationalization part.

## Sample

The films for the sample were chosen carefully and based on specific criteria. IMDB started in 1996 so the sample was limited to films released after 1996. Nevertheless, The steep increase in ranking which can be seen in Figure 4 is not due to films becoming less popular over time, but rather to the fact that IMDb was not widely used between 1998 and 2000. Therefore, there was am additional filter for films from those years.

Films produced outside the United States and animated films were also filtered out, because Hollywood is the focus of this study and voice actors are not represented on screen and this undermines representation. Following Joshi and Mao (2012), the analysis only included films that received a wide release, requiring a minimum of 500 screens at their launch. Observations with missing data were also eliminated.

A graph with a line going up

Description automatically generatedAfter applying the criteria of release date (after 2000), production country (United States), film type (live-action), and wide release (500 screens), the final sample consisted of 2,315 unique films.

Figure 4 Average popularity per year

## Variable operationalization

**Long term audience engagement (DV)**

Long term audience engagement was operationalized using IMDb's MovieMeter, a metric derived from popularity rankings. The score means that film was the most popular with regards to clicks, page views and reviews on IMDB. Therefore, this film score includes direct indicators of LTAE, such as online discussions, reviews, and word-of-mouth conversations. By examining film scores over time, I aimed to measure sustained engagement, where lower scores indicate higher popularity.

Specifically, I measured LTAE as the average MovieMeter ranking of a film over a one-year period, starting in the third year after its release. I chose this metric because it shows how engaged audiences are with a film after a few years, and the average reduces the influence of any spikes or certain drops in popularity. Figure 4 shows the average LTAE scores for films released in different years.

That the average popularity of films after three years decreases over time is logical. Every year, new films are released, increasing the competition for films in the years after. The rise of online streaming services may have played a role for the rapid increase in ranking (decrease in popularity) between 2011 and 2016. [[2]](#footnote-2) Nevertheless, this is speculative, as further research is needed to determine the exact impact of online streaming services on film popularity over time.

**Racial diversity (IV)**

*Ethnicity determination* The Kairos API is chosen because of its efficiency, accuracy (99.63%), and ability to handle a large dataset (Kairos, 2023). In the films a total of 121,898 characters were present. This count includes instances where an actor or actress appeared in multiple films. It also included uncredited people (13.491). The Kairos API analyzed 28,564 images found on IMDb of the total 39,400 unique actors and actresses. [[3]](#footnote-3)

In the few cases where all actors were used for an analysis, such as for robustness checks, the ethnicities of the imageless people were based on their first and last name using the R package Rethnicity, which has an accuracy of around 80%.

Using the Kairos API, I extracted the ethnicity of each actor or actress in the dataset. The API had one challenge: it provides probabilities rather than an assigent that a person belongs to one of the ethnicities. Moreover, the dataset was skewed towards White actors. Figure 5 shows the distribution of probabilities for the different ethnicities, which is unequal.

This is due to the abundance of White actors in the dataset, which creates a lot of low probability values for the other three ethnic groups. Nevertheless, the confidence associated with the different ethnicities did not differ (Asian: 0.9972, Black: 0.9988, Hispanic: 0.9990, White: 0.9985).

Therefore, I established a process to assign ethnicity values to the actors and actresses. The two highest scoring ethnicities on probability where assigned the value of percentage relating to each other. Highestprob / Highestprob + SecondHighestprob. As illustration if a person was assigned the two highest probabilities 0.53 for white and 0.19 for black. It would have (0.53/0.53+0.19) = 0.736 for white. Then if this percentage was above 0.5 the person was assigned a this ethnicity. Using this threshold, I was able to successfully identify the ethnicity for 120,504 characters. For simplicity the remaining characters were removed.

A graph of different sizes and shapes

Description automatically generated with medium confidence

Figure 5 Distribution probabilities ethnicities

*Inverse Simpson diversity index:* After determining the ethnicities of individuals, following previous research I assessed the racial diversity of the entire cast. To measure racial diversity, I used the inverse Simpson index (1949). The Simpson diversity index is a measure of diversity that takes into account the number of ethnicities present, as well as the relative abundance of each ethnicity. It is calculated using the following formula:

D = 1 - / (Σ *n*i(*n*i-1)/N(N-1))

Where: *n* is the number of actresses and actors that belong to an ethnicity i and N is the total number of actresses and actors.

**Authentic inclusive representation (AIR)**

The Bechdel test was modified to measure AIR for three different ethnicities. This approach enables to look at AIR for the three different ethnicities. It will be dichotomous variables for all three different levels. I will refer to the specific Bechdel test for this study further as the reformed Bechdel test. But I will use the specific gradient (T1, T2, T3) more often:

(T1) two named characters of {ethnicity} ethnicity appear in film X.

(T2) who speak to one another.

(T3) about something besides a white character.

*(T1) Non named character filtering:* The first step in the reformed Bechdel test is to filter out non-named characters. To filter generic characters from the dataset, I identified frequently occurring tokens, where a token is a segment of a name divided by spaces. I then removed these tokens using a stop word list. The stop word list eventually contained 915 words, such as "doctor," "agent," and "the." The list can be seen in the Appendix.

I made an exception to the stop word filter: I did not remove a character if the stop word was the first token in their name. For example, "Colonel Rich Bron" was kept. However, there was an addition to this exception which was that if the character's name consisted of only one word. For example, a character named "Colonel" would still be removed.[[4]](#footnote-4)

Table 2 shows that when characters from a particular ethnicity are required to be named (T1), the number of films with two or more characters is noticeably lower. Films that exist in the first column (featuring two or more characters from the same ethnicity) but not in the second column (where at least two of these characters are named) can be characterized as engaging in tokenism. These films are including characters of color without giving them proper names, which could be an indicator of tokenism, where superficial diversity is prioritized over meaningful and authentic representation.

Table 1 (T1) all characters versus named characters

|  |  |  |
| --- | --- | --- |
| Ethnicity | Two characters all cast | Two named characters |
| Black | 1857 | 982 |
| Asian | 1471 | 568 |
| Hispanic | 1508 | 531 |

To delve deeper into the link between inclusive characters and racial diversity, I implemented steps 2 and 3 of the revised Bechdel test using subtitle files. While detailed processing steps are available in Appendix B the following section outlines an overview of this procedure.

*(T2 ,T3) Subtitle file parching:* To assess who speaks to one another (T2) and whether they talk about something besides a white character (T3), I used subtitle files for the hearing impaired. These files can be extracted from a film in the form of .srt files, which are text files with strict formatting. Each subtitle in an .srt file has a unique identifier, precise start and end times, and one or two lines of text. For example, here is the opening of the film "300: Rise of an Empire": 1

00:00:38,363 --> 00:00:40,698

(HORSE NICKERS)

2

00:01:02,654 --> 00:01:07,024

QUEEN GORGO: The oracle's

words stand as a warning.

3

00:01:07,026 --> 00:01:08,225

A prophecy.

4

00:01:08,227 --> 00:01:11,796

"Sparta will fall.

After parching my dataset consisted of scene indices, speakers, individuals mentioned, and the ethnicities of the characters. The final stage involved applying the revised Bechdel Test to this dataset. Films were then categorized based on whether they met the conditions (T2) and (T3) for different ethnicities. This categorization serves as the variables used in the regression models. The following table is an overview of T1, T2 and T3 comparing AC(All Characters) and NC( Named Characters) considering the dataset of 1169 of films for which the subtitle files could be found.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Ethnicity | AC (T1) | NC (T1) | AC (T2) | NC (T2) | AC (T3) | NC (T3) |
| Black | 901 | 503 (0.53) | 414 | 335 (0.81) | 215 | 206 (0.96) |
| Asian | 748 | 334 (0.39) | 180 | 149 (0.83) | 78 | 77 (0.99) |
| Hispanic | 751 | 326 (0.35) | 240 | 199 (0.83) | 104 | 97 (0.93) |

The percentage difference between conversations with all characters (AC) and those with named characters (NC) decreases at each stage from T1 to T3 for every ethnicity. This suggests that, at each step, named characters play a larger role in the observed conversations in the films. In other words, when a conversation meets the criteria of having two people from a specific ethnicity (T2) without a white person (T3), these conversations are typically done by named characters. This indicates a connection between named characters and conversations being more centered around those characters.

**Covariates**

It is important to account for additional factors that have been identified as influencing a film’s success, in doing so this study draws upon previous research. The variables considered in this study include Sequal the star power of Actors and Directors, MPAA rating, Number of screens, Critical Acclaim, Awards, Budget, Genre, Source and Seasonality. Table 3 provides detailed information including which sources identified which variables , the following paragraphs briefly discuss how the variables are measured in this study.

In this study, (SEQUALi) represents the number of predecessors for which the sequel is, which is equal to the number of predecessors plus one. The star power score (STARPOWERi) is derived from Nelson and Glotfelty's (2012) measure, based on the four highest-grossing actors' ranking on The Numbers. (DIRECTORPOWERi) is similarly measured using the highest-grossing directors' ranking on The Numbers. The (CRITICSi) value is the average rating on metacritic.com

This research will use the actual number of award (NOMINATIONSi) as a proxy for award nomination. (WINSi) will also be added to the model to represent awards wins. Because there is an abundance of available film awards this study uses the awards used in the research of Gemser, Leenders and Wijnberg (2008). [[5]](#footnote-5)

(MPAAi) rating is given by the Motion Picture Association of America and is used to rate a film's suitability for certain audiences based on its content. These ratings are encoded as an interval variable as [0 = unrated; 1 = G; 2 = PG; 3 = PG-13; 4 = R;5 = C-17].

(SCREENSi) is the amount of opening theaters the film had according to the Numbers. (BUDGETi) was the production budget available at one of the three data sources used, if multiple production multiple budgets where available across the sources the average was taken.

Moreover, this study introduces 19 genres , Action, Adventure, Comedy, Crime, Drama, Family, Fantasy, Horror, Romance, Musical, Sci-Fi, Mystery, Thriller, Western, Biography, Documentary, History, Music, Sport and War. Because a film could have multiple genres, these dummy variables are not mutually exclusive.

(SPRINGi, SUMMERi, FALLi, WINTERi) Within this study the four seasons are encoded as the following. Spring[March, April, May] Summer [June, July, August] Fall [September, October, November], Winter [December, January, February]. (RUNTIMEi) is included as the actual numerical value in minutes, following (Holbrook, 1999).

Furthermore, following Hofmann, Clement, Völckner, and Hennig-Thurau (2016), multiple dummy variables were added to control for whether the film was ({BASED ON}i) a book, comic, novel, short story, or TV series. Moreover, whether the film is a (REMAKEi) or (SPINOFFi) Similar, to the genre variables these dummy variables are not mutually exclusive because a film could be based on multiple sources. To control for possible differences over time, (YEARi) dummies for every year in the sample were added to the model.

Because log-log linear regressions are used in this research, all control variables that are not dummy variables were log-transformed. Most of these variables had zero values in this situation a small number (0.01) was added.

Finally, it is crucial for this study to be cautious in every step of the process to possibly achieve causality. Therefore, every factor previously mentioned will also be analyzed on its influence on the racial diversity of the film before it is included as a control variable.[[6]](#footnote-6)

Table 3: Measures of Variables

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Variable Name | Description | Measure | Data Source | Academic research |
| Simpson diversity indexi | Measure of diversity which takes into account the number of species present, as well as the relative abundance of each species. | Continuous value between 0-1. 1 being complete diversity. | IMDB, TMDB , Kairos | KRM , H , SM |
| AIRi | Authentically Inclusive Representation. | Dichotomous variable with three separate levels | Subtitles.org | L, R |
| Log(LTAEi) | IMDB popularity score where a higher score means being less popular. | Average ranking over a one year period of time in the third year after release logged. | IMDB |  |
| Covariates |  |  |  |  |
| Log(SEQUALi) | Amount of sequel it is. | Amount of sequel it is logged. | IMDB | KRM, H , KY, CM |
| Log(STARPOWERi) | Log-transformed score of the top three actors in the film + 0.01. | Log-transformed sum of the top 4 actors, the year of the film release. | The Numbers | KRM, H, KY, G, CM |
| Log(DIRECTORPOWERi) | Log-transformed score of the number one director in the film + 0.01. | Log-transformed sum of 100 divided through the director ranking + 0.01 (e.g., log(100/rank 2 +0.00)) for the director one year before the film release. | The Numbers | KRM, H, G, KY, CM |
| Log(CRITICi) | Log-transformed average rating the film received from professional film reviewers + 0.01. | Log-transformed average rating the film received from professional film reviewers | Metacritic | H, KRM, KY, G |
| Log(NOMINATIONSi) | Number of award nominations the film received. | Log transformed number of award nominations the film received + 0.01. | IMDb | KY,KRM, HTS |
| Log(WINSi) | Number of award wins the film received. | Log transformed number of award nominations the film received + 0.01. | IMDB | KY,KRM, HTS |
| Log(MPAAi) | MPAA rating, the film received 1 = Not Rated, 2 = G, 3 = PG, 4 = PG-13, 5 = R, 6 = NC-17 | Log transferred of the interval ranking | IMDb | H, KY, L, BCR, KRM , SD, CM |
| Log(SCREENSi) | Number of screens at release | Total amount of screens logged | Numbers | H , KY, KRM , HTS, CM |
| Log(BUDGETi) | Production budget of film | The average production budget of the data sources | IMDB, Numbers, OMDB | KY,KRM, HTS, CM |
| Log(RUNTIMEi) | Duration of a film in minutes | Log-transformed duration of a film in minutes | IMDb |  |
| ACTIONi | Genre Action | Genre Action = 1, Other = 0 | IMDb | KRM, H , KY, G,CM |
| ADVENTUREi | Genre Adventure | Genre Adventure = 1, Other = 0 | IMDb | - |
| ANIMATIONi | Genre Animation | Genre Animation = 1, Other = 0 | IMDb | - |
| COMEDYi | Genre Comedy | Genre Comedy = 1, Other = 0 | IMDb | - |
| CRIMEi | Genre Crime | Genre Crime = 1, Other = 0 | IMDb | - |
| DRAMAi | Genre Drama | Genre Drama = 1, Other = 0 | IMDb | - |
| FAMILYi | Genre Family | Genre Family = 1, Other = 0 | IMDb | - |
| FANTASYi | Genre Fantasy | Genre Fantasy = 1, Other = 0 | IMDb | - |
| HORRORi | Genre Horror | Genre Horror = 1, Other = 0 | IMDb | - |
| MUSICALi | Genre Musical | Genre Musical = 1, Other = 0 | IMDb | - |
| MYSTERYi | Genre Mystery | Genre Mystery = 1, Other = 0 | IMDb | - |
| ROMANCEi | Genre Romance | Genre Romance = 1, Other = 0 | IMDb | - |
| SCI-FIi | Genre Sci-Fi | Genre Sci-Fi = 1, Other = 0 | IMDb | - |
| THRILLERi | Genre Thriller | Genre Thriller = 1, Other = 0 | IMDb | - |
| WESTERNi | Genre Western | Genre Western = 1, Other = 0 | IMDb | - |
| BIOGRAPHYi | Genre Biography | Genre Biography = 1, Other = 0 | IMDb | - |
| DOCUMENTARYi | Genre Documentary | Genre Documentary = 1, Other = 0 | IMDb | - |
| MUSICi | Genre Music | Genre Music = 1, Other = 0 | IMDb | - |
| HISTORYi | Genre History | Genre History = 1, Other = 0 | IMDb | - |
| SPORTi | Genre Sport | Genre Sport = 1, Other = 0 | IMDb | - |
| SPRINGi | Film released in the spring | Spring release = 1, Other = 0 [Mar, Apr, May] | IMDb | V |
| SUMMERi | Film released in the summer | Summer release = 1, Other = 0 [Jun, Jul, Aug] | IMDb | - |
| AUTUMi | Film released in the autumn | Autum release = 1, Other = 0 [Sep, Oct, Nov] | IMDb | - |
| WINTERi | Film released in the winter | Winter release = 1, Other = 0 [Dec, Jan, Feb] | IMDb | - |
| BOOKi | Film is based on a book | Film is based on a book = 1, other = 0 | IMDb | H |
| COMICi | Film is based on a comic | Film is based on a comic = 1, other = 0 | IMDb | - |
| NOVELi | Film is based on a novel | Film is based on a novel = 1, other = 0 | IMDb | - |
| SHORTSTORi | Film is based on a short story | Film is based on a short story = 1, other = 0 | IMDb | - |
| TVSERIESi | Film is based on TV seriess | Film is based on a TV series = 1, other = 0 | IMDb | - |
| REMAKEi | Film is a remake | Film is a remake = 1, other = 0 | IMDb | - |
| SPINOFFi | Film is a spinoff | Film is a spinoff = 1, other = 0 | IMDb | - |
| YEAR2000i | Year2000 | 2000 = 1, other = 0 | IMDb |  |
| YEAR2001i | Year2001 | 2001 = 1, other = 0 | IMDb |  |
| YEAR2002i | Year2002 | 2002 = 1, other = 0 | IMDb |  |
| YEAR2003i | Year2003 | 2003 = 1, other = 0 | IMDb |  |
| YEAR2004i | Year2004 | 2004 = 1, other = 0 | IMDb |  |
| YEAR2005i | Year2005 | 2005 = 1, other = 0 | IMDb |  |
| YEAR2006i | Year2006 | 2006 = 1, other = 0 | IMDb |  |
| YEAR2007i | Year2007 | 2007 = 1, other = 0 | IMDb |  |
| YEAR2008i | Year2008 | 2008 = 1, other = 0 | IMDb |  |
| YEAR2009i | Year2009 | 2009 = 1, other = 0 | IMDb |  |
| YEAR2010i | Year2010 | 2010 = 1, other = 0 | IMDb |  |
| YEAR2011i | Year2011 | 2011 = 1, other = 0 | IMDb |  |
| YEAR2012i | Year2012 | 2012 = 1, other = 0 | IMDb |  |
| YEAR2013i | Year2013 | 2013 = 1, other = 0 | IMDb |  |
| YEAR2014i | Year2014 | 2014 = 1, other = 0 | IMDb |  |
| YEAR2015i | Year2015 | 2015 = 1, other = 0 | IMDb |  |
| YEAR2016i | Year2016 | 2016 = 1, other = 0 | IMDb |  |
| YEAR2017i | Year2017 | 2017 = 1, other = 0 | IMDb |  |
| YEAR2018i | Year2018 | 2018 = 1, other = 0 | IMDb |  |
| YEAR2019i | Year2019 | 2019 = 1, other = 0 | IMDb |  |

Notes: CM = Clement et al. (2014) , *KRM = Kumar et al., (2022) ;* H = Hofman et.al (2016) ; L = Lazar et al., (2020) ; KY = Kuppuswamy et al. (2016) ; HTS = Hunter et al. (2016; SD = Ramesh & Delen (2006); BCR = Basuroy et. al , (2003), L = Litman , (1983); G = Ghiassi et. al (2017), HL = Hall, (2022) , SM = Smith , (2020)

## Models

Following the approach outlined by Clement, Wu, and Fischer (2014), this research employs log-log linear regressions. However, it is worth noting that numerous continuous variables had zero values, and taking the logarithm of '0' would result in an error. To address this, a small constant value of '+0.01' was added to all films characters which were continuous before taking the logarithm, ensuring meaningful results.

The mediation analysis consists of four models in total. The relationship between racial diversity and AIR was run for all three ethnicities their T3. The last model used for the mediation analysis was using the T3 values of the thnciities to run a regression between AIR and LTAE. The inverse Simpson index, being a number between 0 and 1, for interpretation purposes of the results will not be logged. The detailed model specifications are provided below.

Main relationship:

log(LTAEi) = β0 + β1 × SIMPSONDIVERSITYINDEXi + β2 × SERIESi +

β3 × log(STARPOWERi) + β4 × log(DIRECTORPOWERi) +

β5 × log(CRITICi) + β6 × log(NOMINATIONSi) + β7 × log(WINSi) +

β8 × log(MPAAi) + β9 × log(SCREENSi) + β10 × log(BUDGETi) +

β11 × ACTIONi + β12 × ADVENTUREi + β13 × ANIMATIONi +

β14 × COMEDYi + β15 × CRIMEi + β16 × DRAMAi + β17 × FAMILYi +

β18 × FANTASYi + β19 × HORRORi + β20 × MUSICALi +

β21 × MYSTERYi + β22 × ROMANCEi + β23 × SCI-FIi +

β24 × THRILLERi + β25 × WESTERNi + β26 × BIOGRAPHYi +

β27 × DOCUMENTARYi + β28 × MUSICi + β29 × HISTORYi +

β30 × SPORTi + β31 × SPRINGi + β32 × SUMMERi +

β33 × AUTUMNi + β34 × WINTERi + β35 × log(RUNTIMEi) +

β36 × BOOKi + β37 × COMICi + β38 × NOVELi + β39 × SHORTSTORi

β40 x TVSERIESi  + β41 x REMAKEi + SPINOFFi + β42 ×YEAR2000i +

β43 × YEAR2001i  + β44 × YEAR2002i + β45 x YEAR2003i +

β46 × YEAR2004i + β47 × YEAR2005i + β48 × YEAR2006i +

β49 × YEAR2007i + β50 × YEAR2008i + β51 × YEAR2009i +

β52 × YEAR2010i + β53 × YEAR2011i + β54 × YEAR2012i +

β55 × YEAR2013i + β56 × YEAR2014i + β57 × YEAR2015i +

β58 × YEAR2016i + β59 × YEAR2017i + β60 × YEAR2018i +

β61 × YEAR2019i + εi

Mediation models:

Path A:  
AIR\_Hispanic i = β0 + β1 × SIMPSONDIVERSITYINDEXi + β2 × SERIESi + β3 × log(STARPOWERi) + β4 × log(DIRECTORPOWERi) + … β61× YEAR2018i + β62 × YEAR2019i + εi

AIR\_Black i = β0 + β1 × SIMPSONDIVERSITYINDEXi + β2 × SERIESi + β3 × log(STARPOWERi) + β4 × log(DIRECTORPOWERi) + … β61× YEAR2018i + β62 × YEAR2019i + εi

AIR\_Asiani = β0 + β1 × SIMPSONDIVERSITYINDEXi + β2 × SERIESi + β3 × log(STARPOWERi) + β4 × log(DIRECTORPOWERi) + … β61× YEAR2018i + β62 × YEAR2019i + εi

Path B:

log(LTAEi) = β0 + β1 × AIR\_HispanicT3i + β2 × AIR\_BlackT3i + β3 × AIR\_AsianT3i + β4 × SERIESi + β5 × log(STARPOWERi) + β6 × log(DIRECTORPOWERi) +… β62× YEAR2018i + β63 × YEAR2019i + εi

# Results

In this section, the results of the study are discussed. First, to establish a comprehensive overview of the dataset, descriptive and frequency statistics for the variables are presented. After the assumptions of the regression models, including multicollinearity and independence are assessed. Finally, the multiple regression models and their results are described. It is crucial to note that, as mentioned previously, popularity represents the average rank of a film in the third year post-release. Consequently, a higher value indicates less popularity .

## Descriptive Statistics

Table 2 presents descriptive statistics for the continuous variables used in the models before being logged. This table displays the number of observations per variable (N), as well as the mean, standard deviation (SD), minimum, and maximum values.

Table 3: Descriptive statistics

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Variable Name** | **N** | **Mean** | **SD** | **Minimum** | **Maximum** |
| *Dependent variable* |  |  |  |  |  |
| Avg Rank Third Year | 2425 | 3410 | 4387 | 75.92 | 103633 |
| *Independent variable* |  |  |  |  |  |
| Inverse Simpson index | 2425 | 0.41 | 0.15 | 0 | 1 |
| *Control Variables* |  |  |  |  |  |
| Opening screens | 2425 | 2650.06 | 826.48 | 502 | 4662 |
| Runtime | 2425 | 108.69 | 17.19 | 74 | 219 |
| Budget | 2425 | 49,442,970 | 48,828,780 | 12 | 356,000,000 |
| Nominee | 2425 | 14.10 | 32.37 | 0 | 462 |
| Winner | 2425 | 5.39 | 20.62 | 0 | 490 |
| Director power | 2425 | 0.03 | 0.09 | 0 | 1.0 |
| Star Power | 2425 | 0.06 | 0.15 | 0 | 1.5 |
| Meta score | 2425 | 47.66 | 16.46 | 0 | 96 |
| Sequel | 2425 | 0.45 | 1.69 | 0 | 22 |
| Remake | 2425 | 0.096 | 0.327 | 0 | 3 |
| MPAA | 2425 | 3.23 | 7.05 | 1 | 4 |

Table 4, Table 5, and Table 6 present the frequency statistics for the dummy variables for year, genre, seasonality, and the based-on variables. These tables provide the number of observations per variable (N) , the count of occurrences where the dummy variable yielded a '1' as its outcome. It also displays the percentage this dummy variable represent compared to the total of observations.

Table 4: Year dummies

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Year** | **N** | **Percentage** |  | **Year** | **N** | **Percentage** |
| 2000 | 117 | 4.82 |  | 2010 | 119 | 4.91 |
| 2001 | 122 | 5.03 |  | 2011 | 121 | 4.99 |
| 2002 | 120 | 4.95 |  | 2012 | 106 | 4.37 |
| 2003 | 116 | 4.78 |  | 2013 | 109 | 4.49 |
| 2004 | 127 | 5.24 |  | 2014 | 118 | 4.87 |
| 2005 | 134 | 5.53 |  | 2015 | 110 | 4.54 |
| 2006 | 143 | 5.90 |  | 2016 | 134 | 5.53 |
| 2007 | 133 | 5.48 |  | 2017 | 104 | 4.29 |
| 2008 | 130 | 5.36 |  | 2018 | 132 | 5.44 |
| 2009 | 125 | 5.15 |  | 2019 | 105 | 4.33 |

Table 5: Genre dummies

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Genre** | **N** | **Percentage** |  | **Genre** | **N** | **Percentage** |
| Drama | 1064 | 43.88 |  | Fantasy | 325 | 13.40 |
| Comedy | 949 | 39.13 |  | Family | 246 | 10.14 |
| Thriller | 863 | 35.59 |  | Biography | 146 | 6.02 |
| Action | 801 | 33.03 |  | Sport | 119 | 4.91 |
| Romance | 518 | 21.36 |  | Music | 102 | 4.21 |
| Adventure | 495 | 20.41 |  | History | 91 | 3.75 |
| Crime | 465 | 19.18 |  | War | 87 | 3.59 |
| Sci.Fi | 374 | 15.42 |  | Musical | 32 | 1.32 |
| Mystery | 349 | 14.39 |  | Documentary | 32 | 1.32 |
| Horror | 341 | 14.06 |  |  |  |  |

Table 6 : Remaining dummies

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Season** | **N** | **Percentage** |  | **Variable** | **N** | **Percentage** |
| Fall | 649 | 26.76 |  | Based on novel | 387 | 15.96 |
| Summer | 616 | 25.40 |  | Based on comic book | 124 | 5.11 |
| Spring | 613 | 25.28 |  | Based on book | 99 | 4.08 |
| Winter | 547 | 22.56 |  | Spinoff | 52 | 2.14 |
|  |  |  |  | Based on book series | 1 | 0.04 |
|  |  |  |  | Based on short story | 23 | 0.95 |
|  |  |  |  | Based on play | 16 | 0.66 |

## Assumptions of log-log linear and logistic regression model

Two statistical models were employed in this study: a log-log linear model for the main analysis and a logistic regression model for the mediation analysis. The log-log model rests on four specific assumptions: no multicollinearity, homoscedasticity, independence, and normality. In contrast, the logistic model is less sensitive to violations of normality and homoscedasticity.

*Normality:* Non-normality of the residuals is considered unproblematic due to the substantial sample size and taking the log-log transformation model.

*Independence:* Independence of observations is a key assumption of regression analysis. It means that the residuals (the difference between the actual and predicted values of the dependent variable) should not be correlated with each other. In this study, we use cross-sectional data on movies, where each movie is represented by a single observation. This means that the observations are likely to be independent, and the assumption of independence is satisfied.

*Multicollinearity:* To evaluate multicollinearity within the models, a correlation matrix was constructed, and variance inflation factors (VIFs) were computed for all models. The detailed correlation matrix can be found in Appendix C. The analysis uncovered instances of notable correlation among specific variables.

Notably, budget demonstrated positive correlations with Screens (0.598), Runtime (0.522), and (G) Adventure (0.530). [[7]](#footnote-7) Conversely, the genre ‘Family’ had a substantial negative correlation with (log)MPAA (-0.639). This relationship is straightforward to explain. Additionally, strong positive correlations were observed between (log) Director power and Screens (0.530). [[8]](#footnote-8) Explanation for these relationships provided in the footnote.

These correlations suggest potentially significant relationships and interdependencies between these sets of variables within the dataset. This can cause a few issues in the model. Therefore, VIF analysis was conducted across models.

The main regression and the path A logistic model for Black T3 showed no multicollinearity issues. However, the logistic models for Hispanic T3 and Asian T3 exhibited concerns, with certain VIF values exceeding 10. Particularly, the exclusion of the year 2000 variable in the Asian T3 model resulted in high VIF values for the remaining year variables, some surpassing 3 million. On the other hand, the regression model for path B, encompassing the T3 variables, did not manifest multicollinearity concerns.

*Homoscedastic:* The log-log regression model revealed heteroscedasticity, indicated by a Breusch-Pagan test resulting in a highly significant p-value of 0.000979. Heteroskedasticity violates the assumption of constant variance in the OLS standard errors, undermining the reliability of regression coefficient significance. To address this issue, robust standard errors, adjusting for heteroskedasticity by using a different variance error estimator, were implemented. This adjustment doesn't alter point estimates but enhances the accuracy of standard errors and confidence intervals. Therefore, the robust standard errors approach was employed in both the log-log regression models. The logistic models used for path A as mentioned before are robust against the violation of homoscedasticity.

## Interpreting the results

*Regression main analysis:* Table 3 shows the significant variables in the main analysis of the relationship between racial diversity measured by the inverse Simpson index and LTAE. In the table only the significant variables are included.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Variable | Coefficient | Sign |  | Variable | Coefficient | Sign |
| Inverse Simpson index | 0.268 | < 0.001 \*\*\* |  |  |  |  |
|  |  |  |  |  |  |  |
| Log(Screens) | -0.461 | < 0.001 \*\*\* |  | *Biography* | 0.163 | 0.006 \*\* |
| Log(Runtime) | -1.351 | < 0.001 \*\*\* |  | *Sport* | 0.136 | 0.025 \* |
| Log(MPAA) | -0.711 | < 0.001 \*\*\* |  | *War* | 0.143 | 0.043 \* |
| Log(Average budget) | -0.047 | 0.008 \*\* |  | *Family* | 0.208 | < 0.001 \*\*\* |
| Log(Sequal) | 0.006 | < 0.001 \*\*\* |  | *Musical* | -0.292 | 0.007 \*\* |
| Based on book | -0.132 | 0.034 \* |  | *History* | 0.159 | 0.028 \* |
| Based on play | 0.375 | 0.012 \* |  | *Documentary* | 0.749 | < 0.001 \*\*\* |
| Based on comic book | -0.314 | < 0.001 \*\*\* |  | *Western* | 0.492 | < 0.001 \*\*\* |
| Based on novel | -0.108 | 0.002 \*\* |  | *2009* | 0.172 | 0.023 \* |
| Log(Nominee) | -0.009 | < 0.001 \*\*\* |  | *2010* | 0.201 | 0.009 \*\* |
| Log(Winner) | -0.014 | < 0.001 \*\*\* |  | *2011* | 0.351 | < 0.001 \*\*\* |
| Log(Director Power) | -0.010 | < 0.001 \*\*\* |  | *2012* | 0.502 | < 0.001 \*\*\* |
| Log(Metascore) | -0.036 | < 0.001 \*\*\* |  | *2013* | 0.617 | < 0.001 \*\*\* |
| Log(Star power) | -0.004 | 0.032 \*\* |  | *2014* | 0.791 | < 0.001 \*\*\* |
| Adventure | -0.135 | < 0.001 \*\*\* |  | *2015* | 0.791 | < 0.001 \*\*\* |
| Comedy | 0.130 | < 0.001 \*\*\* |  | *2016* | 0.879 | < 0.001 \*\*\* |
| Drama | 0.149 | < 0.001 \*\*\* |  | *2017* | 0.823 | < 0.001 \*\*\* |
| Romance | -0.085 | 0.013 \* |  | *2018* | 1.021 | < 0.001 \*\*\* |
| Sci.Fi | -0.109 | 0.006 \*\* |  | *2019* | 0.968 | < 0.001 \*\*\* |
| R2 | 0.626 |  |  | *Adj R2* | 0.617 |  |
| F Statistic | 65.980\*\*\* | (df = 60; 2364) |  |  |  |  |

*Significance levels: \* p < 0.05, \*\* p < 0.01, \*\*\* p < 0.001*

The model exhibited moderate performance, revealing an R-squared value of 0.626, explaining 62.6% of the dependent variable's variation. The high adjusted R-squared value of 0.617 implies that overfitting is unlikely.

The model outcomes align with prior research, emphasizing the significance of most variables 39 variables displayed significant effects. Among the findings, 13 out of 19 genres exhibited significance, with diverse positive and negative effects. For instance, 'Musical' displayed the largest positive effect (β = -0.292; ρ = 0.007), while 'Documentary' portrayed the most significant negative impact (β = 0.749; ρ = < 0.001).

One intriguing finding is that the seasonality variables are insignificant. Nevertheless, which is understandable given the nature of long-term engagement. The analysis spans a year in the third year after release, which shows that the initial impact of seasonal influences might wonder off over time. Suggesting seasonality is more related popularity at release rather than after a few years.

Furthermore, the year dummies indicate that the decline in popularity becomes significant around 2009, compared to the baseline year of 2000. This aligns with the findings in Figure 4, which showed the average popularity ranking per year. Films released in 2018 appeared to be the least popular (β = 1.021; ρ = < 0.001), with no year showing a positive correlation with popularity.

Additionally, films based on existing sources, such as books (β = -0.132; ρ = 0.034), novels (β = -0.108; ρ = 0.002), or comic books (β = -0.314; ρ = < 0.001), tended to be more popular. However, this was not the case for films based on short plays (β = 0.375; ρ = 0.012). Moreover, for sequels, as the number of films in a franchise increased, popularity decreased (β = 0.006; ρ = < 0.001).

Moreover, another variable indicating an existing audience base sequels, showed that when later films in franchises become less popular. (β = 0.006 ; ρ = < 0.001).

The film runtime is positively related with its popularity and has actually the most effect ( β = -1.351; ρ = 0.034), this can be due to previous mentioned correlation with budget. Films that are longer in runtime have bigger productions budget , meaning more advertising.

As expected, budget itself was also positively correlated (β = -0.047; ρ = 0.008). Moreover, log(Screens) which showed correlation with budget also showed to have an positive effect on popularity (β = -0.461 ; ρ = < 0.001). Moreover, the variable log(Director Power) which was on itself correlated to opening screens was also positively correlated (β = -0.010 ; ρ = < 0.001), as was log(Star Power) (β = -0.004 ; ρ = 0. 032) The last characteristic the film makers have any influence on which was log(MPAA) was also positively correlated (β = -0.711 ; ρ = < 0.001).

Lastly, the final continuous variable racial diversity shows an unexpected finding with the subtle but significant negative impact of racial diversity on popularity. Due to the nature of the log-log model, all results related to continuous variables can be interpreted as elasticities. For instance, on average, a 10% increase in runtime translates to a 13.51% decrease in average popularity ranking in the third year after release. Therefore, the estimate of the inverse Simpson index means that a film which is completely diverse 1 on average has a increase in the popularity ranking of 26% holding other variables constant.

With regards to all dummy variables most variables showed expected relationships. The variables related to critical acclaim, including log(Nominee) (β = -0.009; ρ = < 0.001), log(Winner) (β = -0.014; ρ = < 0.001), and log(Metascore) (β = -0.036; ρ = < 0.001), were all positive.

With the dummy variables because the Dependent variable is logged it’s effect can be read as If 𝑥 is changed by 1 unit, 𝑦 is expected to change by 100 𝛽1 percent. So this means that for 2018 the films were 10% less popular than films in 2000. Moreover, when a film has a musical as genre it’s on average 29% more popular then when a film did not have musical as genre.

## Mediation

*A paths (Hispanic T3, Black T3, Asian T3) logistic regression:* The following table shows the significant coefficients variables that are related to T3 of AIR as dependent variable. As expected The Inverse Simpson index exhibited significant effects across all three ethnicities, portraying values of 3.622\*\*\* for Hispanic, 6.359\*\*\* for Asian, and 5.080\*\*\* for Black, suggesting that racial diversity is positively correlated of the film having a conversation between two people from an ethnicity without a white person.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Hispanic | Asian | Black |
| Inverse Simpson index | 3.622\*\*\* (0.916) | 6.359\*\*\* (1.151) | 5.080\*\*\*  (0.697) |
| (L) runtime | 3.556\*\*\* (1.165) |  |  |
| Log(MPAA) |  | -2.320\*\* (1.061) |  |
| Sequel | -0.713\*\* (0.304) | -0.590\*\* (0.296) |  |
| Based on book | -1.545\* (0.811) | 1.230\*\*  (0.510) |  |
| Based on novel |  |  | -0.616\*\* (0.293) |
| Dir power |  |  | 2.607\*\*  (1.153) |
| Mystery | -0.844\* (0.450) |  | -0.719\*\* (0.319) |
| Thriller |  | -0.723\* (0.388) |  |
| Romance |  | - 1.776\*\*\*  (0.545) |  |
| Sci.Fi |  | -1.210\*\*\* (0.467) |  |
| Sport |  |  | 1.023\*\*  (0.408) |
| Family |  | -1.481\*\* (0.705) |  |
| Musical |  |  | 1.365\*\*  (0.660) |
| History | 1.513\*\*  (0.630) |  |  |
| Music | 1.121\*\*  (0.510) |  |  |
| 2018 | 1.976\* (1.083) |  |  |

*Significance levels: \* p < 0.05, \*\* p < 0.01, \*\*\* p < 0.001*

Moreover, in the analysis of three logistic models, distinct patterns emerged for each ethnic group. For Hispanic T3, film runtime (β = 3.622), indicated a substantial influence. Additionally, the genres History (β = 1.513) and Music (β = 1.121) demonstrated positive relations with the T3 dummy variable for Hispanic, while the year 2018 was also positively correlated (β = 1.976 Conversely, variables such as Sequel (β = -0.713), Mystery (β = -0.844), and Based on book (β = -1.545) showed negative correlations, suggesting a decreased likelihood of T3 inclusion for Hispanic films, particularly for sequels.

In contrast, Asian T3 exhibited a different pattern, with Based on book being the only positively related variable (β = 1.230). Conversely, log(MPAA) (β = -2.320), log(Sequel) (β = -0.590), and genres like Thriller (β = -0.723), Romance (β = -1.776), Sci-Fi (β = -1.210), and Family (β = -1.481) displayed negative relationships with Asian T3, indicating a decreased likelihood of the condition.

For Black T3, the likelihood of the condition increased for Musical (β = 1.365) and Sport films (β = 1.023), as well as when director power was higher (β = 2.607). Conversely, films categorized as Mystery (β = -0.719) or based on a novel (β = 0.616) were less likely to have the condition.

*B path (Hispanic T3, Black T3, Asian T3) log-log regression:* Given that the inverse Simpson Diversity index exhibits a positive correlation with all three ethnicities and they pass the test, it becomes crucial to explore whether a film passing the test for these ethnicities influences its popularity ranking. With information available for different levels of AIR (T1, T2, and T3), regression analysis was easily conducted for all three levels. The following table presents the results for each model. Additionally, an extra column was included to highlight the distinction between samples that could be processed by subtitles and those that could not. This differentiation is particularly relevant because the condition T1 could be applied to the sample, impacting both the subset and the entire dataset.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Variable | T3 | T2 | T1 | T1 entire dataset |
| `2001` | -0.038 | -0.029 | -0.039 | -0.067 |
| `2002` | 0.251 \* | 0.267 \* | 0.276 \* | 0.105 |
| `2003` | 0.25 \* | 0.26 \* | 0.249 \* | 0.122 |
| `2004` | 0.078 | 0.095 | 0.073 | 0.046 |
| `2005` | 0.282 \* | 0.29 \* | 0.272 \* | 0.201 \*\* |
| `2006` | 0.204 | 0.227 \* | 0.223 \* | 0.163 \* |
| `2007` | 0.263 \* | 0.281 \* | 0.251 \* | 0.167 \* |
| `2008` | 0.12 | 0.137 | 0.117 | 0.095 |
| `2009` | 0.264 \* | 0.277 \* | 0.261 \* | 0.206 \*\* |
| `2010` | 0.464 \*\*\* | 0.473 \*\*\* | 0.468 \*\*\* | 0.285 \*\*\* |
| `2011` | 0.519 \*\*\* | 0.52 \*\*\* | 0.515 \*\*\* | 0.432 \*\*\* |
| `2012` | 0.634 \*\*\* | 0.641 \*\*\* | 0.63 \*\*\* | 0.573 \*\*\* |
| `2013` | 0.802 \*\*\* | 0.795 \*\*\* | 0.804 \*\*\* | 0.677 \*\*\* |
| `2014` | 0.907 \*\*\* | 0.92 \*\*\* | 0.924 \*\*\* | 0.85 \*\*\* |
| `2015` | 0.861 \*\*\* | 0.86 \*\*\* | 0.874 \*\*\* | 0.85 \*\*\* |
| `2016` | 1.057 \*\*\* | 1.085 \*\*\* | 1.086 \*\*\* | 0.933 \*\*\* |
| `2017` | 0.961 \*\*\* | 0.942 \*\*\* | 1.004 \*\*\* | 0.851 \*\*\* |
| `2018` | 1.183 \*\*\* | 1.184 \*\*\* | 1.228 \*\*\* | 1.086 \*\*\* |
| `2019` | 1.072 \*\*\* | 1.065 \*\*\* | 1.14 \*\*\* | 1.063 \*\*\* |
| Action | -0.065 | -0.062 | -0.058 | -0.086 \*\* |
| Adventure | -0.074 | -0.062 | -0.074 | -0.074 \* |
| Biography | 0.293 \*\*\* | 0.292 \*\*\* | 0.295 \*\*\* | 0.227 \*\*\* |
| Comedy | 0.14 \*\* | 0.137 \*\* | 0.134 \*\* | 0.109 \*\*\* |
| Crime | 0.034 | 0.026 | 0.048 | 0.052 |
| Documentary | 0.942 \*\*\* | 0.942 \*\*\* | 0.834 \*\* | 1.123 \*\*\* |
| Drama | 0.132 \*\* | 0.133 \*\* | 0.131 \*\* | 0.15 \*\*\* |
| Fall | -0.04 | -0.031 | -0.029 | 0.058 |
| Family | 0.249 \*\*\* | 0.26 \*\*\* | 0.264 \*\*\* | 0.221 \*\*\* |
| Fantasy | -0.034 | -0.032 | -0.042 | -0.045 |
| History | 0.157 | 0.163 | 0.147 | 0.145 \* |
| Horror | -0.01 | -0.008 | -0.019 | 0.075 |
| Based on book | -0.117 | -0.121 | -0.115 | -0.148 \*\* |
| Based on comic book | -0.229 \*\* | -0.201 \*\* | -0.218 \*\* | -0.225 \*\*\* |
| Based on novel | -0.12 \*\* | -0.117 \*\* | -0.144 \*\* | -0.103 \*\* |
| Based on play | 0.389 | 0.379 | 0.34 | 0.423 \*\* |
| Based on short story | 0.051 | 0.065 | 0.015 | 0.066 |
| Sequel | 0.019 \* | 0.019 \* | 0.018 \* | 0.025 \*\*\* |
| Spinoff | -0.045 | -0.047 | -0.051 | -0.042 |
| Log(Budget) | -0.037 | -0.044 | -0.043 | -0.039 \* |
| Log(Screens) | -0.462 \*\*\* | -0.468 \*\*\* | -0.476 \*\*\* | -0.485 \*\*\* |
| Log(Runtime) | -0.927 \*\*\* | -0.93 \*\*\* | -0.934 \*\*\* | -0.842 \*\*\* |
| Log(MPAA) | -0.552 \*\*\* | -0.527 \*\*\* | -0.522 \*\*\* | -0.634 \*\*\* |
| Log(Director Power) | -0.282 \*\*\* | -0.27 \*\*\* | -0.241 \*\*\* | -0.135 \*\*\* |
| Log(Metascore) | -0.295 \*\*\* | -0.3 \*\*\* | -0.29 \*\*\* | -0.207 \*\*\* |
| Log(Nominee) | -0.089 \*\*\* | -0.088 \*\*\* | -0.088 \*\*\* | -0.092 \*\*\* |
| Log(Remake) | 0.013 | 0.011 | 0.011 | 0.029 |
| Log(Star power) | -0.03 | -0.034 | -0.029 | -0.032 |
| Log(Winner) | -0.095 \*\*\* | -0.094 \*\*\* | -0.097 \*\*\* | -0.1 \*\*\* |
| Music | 0.242 \*\* | 0.254 \*\* | 0.27 \*\* | 0.081 |
| Musical | -0.012 | 0.007 | 0.019 | -0.185 |
| Mystery | 0.027 | 0.018 | -0.003 | -0.041 |
| Romance | -0.146 \*\* | -0.138 \*\* | -0.147 \*\* | -0.114 \*\*\* |
| Sci.Fi | -0.008 | -0.011 | -0.005 | -0.08 \* |
| Sport | -0.015 | -0.008 | 0.028 | 0.072 |
| Spring | -0.027 | -0.016 | -0.02 | 0.027 |
| Summer | -0.063 | -0.054 | -0.055 | 0.024 |
| Thriller | 0.012 | 0.02 | 0.018 | 0.011 |
| War | 0.096 | 0.103 | 0.118 | 0.108 |
| Western | 0.528 \*\* | 0.523 \*\* | 0.545 \*\* | 0.442 \*\*\* |
| Asian\_condition\_t3 | 0.038 |  |  |  |
| Hispanic\_condition\_t3 | 0.061 |  |  |  |
| Black\_condition\_t3 | 0.251 \*\*\* |  |  |  |
| Asian\_condition\_t2 |  | 0.018 |  |  |
| Hispanic\_condition\_t2 |  | 0.044 |  |  |
| Black\_condition\_t2 |  | 0.185 \*\*\* |  |  |
| Asian\_t1 |  |  | 0.002 | -0.009 |
| Hispanic\_t1 |  |  | -0.044 | -0.046  (0.006) |
| Black\_t1 |  |  | 0.026 | 0.085 \*\*\* |
| R2 | 0.725 | 0.722 | 0.7141 | 0.675 |
| Adjusted R2 | 0.710 | 0.707 | 0.698 | 0.666 |
| Number of Observations | 1105 | 1105 | 1105 | 2319 |
| F Statistic | 47.354\*\*\* | 46.664\*\*\* | 44.51\*\*\* | 77.669\*\*\* |

*Significance levels: \* p < 0.05, \*\* p < 0.01, \*\*\* p < 0.001*

Starting with the model fits it can be seen that the R2 and R2 adjusted is high for all models. It can be seen however with the difference in explanatory power between T1 the entire dataset (R2 = 0.675) and the sample (R2 = 0.675) that the model is better in predicting for the sample dataset. T2 (R2 = 0.707) and T3 (R2 = 0.710) are very close to each other and T1 is a bit less good. All models also outperform the model with the inverse Simpson diversity as IV (R2 = 0. 626) . Even the T1 model that was applied to the entire dataset.

Looking at the variables off interest we can see that the Black ethnicity had a negative correlation with average ranking in all three models. The Hispanic T1 condition shows significance in the entire dataset model. Nevertheless, this significance is not seen in the model for the sample dataset.

C path

All results did not go along with the expected hypotheses. Therefore, an additional analysis was made.

# Additional analysis

The last remark this study would like to make is that prior studies (Malik, 2022; Kuppuswamy, 2016) have overlooked cofounding variables and macro environmental factors, and have largely focused solely on the relationship between racial diversity and film success. As explained previously, films and culture are deeply intertwined. In today’s society the following values are seen as highly important belonging, community, and personal growth, which are all closely related to representation. (Neufeld, 2020) It is proven that films that properly represent the cultural zeitgeist in which the film is made are more successful. (Ettema, 2005)

Therefore, it is reasonable to assume that films that reflect the values related to representation will be more successful in today's cultural landscape. However, as societal norms and values evolve, this appreciation might wonder off. In this section this study aims to explore how much of a film's success is due to the effects caused by representation, and how much is due to the degree the films is displaying the current cultural zeitgeist which is focused on representation.

Cultural resonance, refers to how well a film connects with the cultural values, experiences, and zeitgeist of its audience. It can be achieved by either reflecting or challenging the audience's own culture, values, and experiences in a thought-provoking way. (Ettema, 2005) Representation is key, as films that represent different cultures and experiences can broaden audiences and create a sense of connection. (Bamford, 2018)

As illustration, the film Black Panther was praised for its positive portrayal of African culture and its representation of African people. It was released at a time when representation was a major topic of discussion, and its popularity amplified the conversation about race and representation. Additionally, its positive portrayal of African culture helped to promote African fashion. Thus, Black Panther is both a product of culture, parts of its success is caused by culture and it is a force for change in culture.

## Culture as cofound/moderator

Culture has a big impact on how long audiences stay engaged with a film. Racially diverse films often explore important social and cultural issues, which can lead to lasting discussions about race, identity, and social justice. As Garrett (2020) points out, "Films about race offer us the chance to grapple with past and present constructs of racism, power, and oppression." This shows that cultural shifts are driving conversations about racial diversity, which are essential for keeping audiences engaged in the long term. This underscores the idea that when films activate these conversations they will remain more under the attention for longer periods of time.

Moreover, contemporary film critics place a high value on representation and inclusion in media. (Akser, 2021) As a result, films featuring racially diverse casts tend to receive more favorable critical reception, which in itself contributes to LTAE. Finally, cinema's transformative capacity on culture extends to its influence on the hiring practices within the industry, resulting in increased racial diversity in films. (Khrebtan-Hörhager, 2011) With regards to the above considerations, the following hypothesis is proposed:

**H4**: The relationship between racial diversity and LTAE is cofounded by culture resonance.

*Variable operationalization*: Because films are released every year we can do two things either create a step dummy and assign films that are released the moment racial representation becomes a major topic in our cultural zeitgeist. And also include this as an interaction term with the inverted Simpson index. Another option would be a diff in diff analysis. Because it is not possible to make a treatment and a control group because all films are released at a different moment in time the first approach is chosen.

I used the ‘natural shock’ concept of a diff in diff analysis. In the context of a difference-in-differences (DiD) analysis, a "natural shock" refers to an external event or occurrence that affects one group or entity being studied but not another group, and it is not caused by any deliberate intervention or treatment by the researchers. This moment was the event #oscarssowhite which took place in January 2015. Quantifying whenever racial representation started to become a major topic in today’s culture.

*Model* : log(LTAEi) = β0 + β1 × SIMPSONDIVERSITYINDEXi \* β2 × FILMSAFTER2015i + β3 × log(STARPOWERi) + β4 × log(DIRECTORPOWERi) + …. β62× YEAR2018i + β63 × YEAR2019i + εi

## Results

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Variable | Model Step Inverted Simpson index | Model step T3 | Model step T2 | Model step T1 |
| `2001` | -0.081 | -0.101 | -0.103 | -0.074 |
| `2002` | 0.077 | 0.202 | 0.199 | 0.09 |
| `2003` | 0.075 | 0.219 | 0.223 | 0.075 |
| `2004` | -0.01 | 0.051 | 0.059 | 0.005 |
| `2005` | 0.14 | 0.201 | 0.194 | 0.156 \* |
| `2006` | 0.094 | 0.155 | 0.161 | 0.107 |
| `2007` | 0.124 | 0.183 | 0.187 | 0.128 |
| `2008` | 0.032 | 0.043 | 0.054 | 0.05 |
| `2009` | 0.175 \* | 0.2 | 0.201 | 0.187 \* |
| `2010` | 0.202 \*\* | 0.38 \*\* | 0.38 \*\* | 0.215 \*\* |
| `2011` | 0.353 \*\*\* | 0.442 \*\*\* | 0.434 \*\*\* | 0.374 \*\*\* |
| `2012` | 0.505 \*\*\* | 0.58 \*\*\* | 0.571 \*\*\* | 0.521 \*\*\* |
| `2013` | 0.622 \*\*\* | 0.754 \*\*\* | 0.736 \*\*\* | 0.639 \*\*\* |
| `2014` | 0.799 \*\*\* | 0.878 \*\*\* | 0.879 \*\*\* | 0.832 \*\*\* |
| `2015` | 0.797 \*\*\* | 0.914 \*\*\* | 0.898 \*\*\* | 0.831 \*\*\* |
| `2016` | 0.857 \*\*\* | 1.06 \*\*\* | 1.075 \*\*\* | 0.921 \*\*\* |
| `2017` | 0.804 \*\*\* | 1.043 \*\*\* | 1.052 \*\*\* | 0.914 \*\*\* |
| `2018` | 1.016 \*\*\* | 1.234 \*\*\* | 1.275 \*\*\* | 1.107 \*\*\* |
| `2019` | 0.958 \*\*\* | 1.119 \*\*\* | 1.13 \*\*\* | 1.098 \*\*\* |
| Action | -0.039 | 0.003 | 0 | -0.032 |
| Adventure | -0.136 \*\*\* | -0.149 \*\* | -0.132 \* | -0.127 \*\* |
| after\_jan\_2015 | -0.065 | -0.12 | -0.094 | 0.066 |
| Comedy | 0.13 \*\*\* | 0.162 \*\* | 0.154 \*\* | 0.119 \*\*\* |
| Crime | 0.045 | 0.02 | 0.006 | 0.052 |
| Documentary | 0.753 \*\*\* | 0.982 \*\*\* | 0.972 \*\*\* | 1.155 \*\*\* |
| Drama | 0.141 \*\*\* | 0.139 \*\* | 0.134 \*\* | 0.132 \*\*\* |
| Fall | 0.043 | -0.067 | -0.056 | 0.036 |
| Family | 0.21 \*\*\* | 0.244 \*\* | 0.246 \*\* | 0.179 \*\* |
| Fantasy | -0.047 | -0.05 | -0.05 | -0.052 |
| Biography | 0.164 \*\* | 0.261 \*\* | 0.251 \*\* | 0.161 \*\* |
| History | 0.162 \* | 0.206 | 0.214 \* | 0.132 |
| Horror | 0.078 | 0.016 | 0.018 | 0.071 |
| Based on book | -0.136 \* | -0.13 | -0.129 | -0.138 \* |
| Based on comic book | -0.303 \*\*\* | -0.329 \*\* | -0.277 \*\* | -0.302 \*\*\* |
| Based on novel | -0.108 \*\* | -0.131 \*\* | -0.123 \* | -0.11 \*\* |
| Based on play | 0.379 \* | 0.208 | 0.191 | 0.351 \* |
| Based on short story | -0.022 | 0.037 | 0.056 | 0.017 |
| sequel | 0.02 \*\* | 0.012 | 0.011 | 0.019 \*\* |
| spinoff | -0.058 | -0.073 | -0.083 | -0.053 |
| log(Budget) | -0.046 \*\* | -0.045 | -0.053 | -0.044 \* |
| log(Screens) | -0.454 \*\*\* | -0.409 \*\*\* | -0.41 \*\*\* | -0.473 \*\*\* |
| log(Runtime) | -1.342 \*\*\* | -1.635 \*\*\* | -1.625 \*\*\* | -1.418 \*\*\* |
| log(MPAA) | -0.716 \*\*\* | -0.65 \*\*\* | -0.633 \*\*\* | -0.763 \*\*\* |
| Log(Dir Power) | -0.009 \*\*\* | -0.012 \*\*\* | -0.012 \*\*\* | -0.009 \*\*\* |
| Log(Meta score) | -0.036 \*\*\* | -0.067 \*\*\* | -0.065 \*\*\* | -0.039 \*\*\* |
| Log(Nominee) | -0.009 \*\*\* | -0.01 \*\*\* | -0.01 \*\*\* | -0.008 \*\*\* |
| Log(Remake) | 0.003 | 0 | 0 | 0.003 |
| Log(Star power) | -0.004 \* | -0.004 | -0.003 | -0.004 \* |
| Log(Winner) | -0.014 \*\*\* | -0.015 \*\*\* | -0.015 \*\*\* | -0.015 \*\*\* |
| Music | 0.07 | 0.275 \*\* | 0.297 \*\* | 0.062 |
| Musical | -0.309 \*\* | -0.176 | -0.145 | -0.321 \*\* |
| Mystery | -0.054 | 0.006 | -0.003 | -0.062 |
| Romance | -0.091 \*\* | -0.118 \* | -0.112 \* | -0.084 \* |
| Sci.Fi | -0.11 \*\* | -0.052 | -0.058 | -0.115 \*\* |
| Sport | 0.125 \* | 0.038 | 0.039 | 0.105 |
| Spring | 0.017 | -0.027 | -0.013 | 0.008 |
| Summer | -0.014 | -0.102 \* | -0.098 | -0.014 |
| Thriller | 0.036 | 0.023 | 0.027 | 0.037 |
| War | 0.138 | 0.166 | 0.175 | 0.173 \* |
| Western | 0.482 \*\*\* | 0.709 \*\*\* | 0.708 \*\*\* | 0.483 \*\*\* |
| Inverted Simpson index | 0.239 \*\* |  |  |  |
| simpson\_index:a\_jan\_2015 | 0.169 |  |  |  |
| jan\_2015:Asian\_T1 |  |  |  | -0.181 \*\* |
| jan\_2015:Black\_T1 |  |  |  | -0.133 \* |
| jan\_2015:Hispanic\_1 |  |  |  | 0.147 |
| Asian\_T1 |  |  |  | 0.038 |
| Black\_T1 |  |  |  | 0.12 \*\*\* |
| Hispanic\_T1 |  |  |  | - 0.07 \* |
| jan\_2015:Asian\_T2 |  |  | -0.302 \*\* |  |
| jan\_2015:Black\_T2 |  |  | -0.065 |  |
| jan\_2015:Hispanic\_2 |  |  | 0.091 |  |
| Asian\_T2 |  |  | 0.095 |  |
| Black\_T2 |  |  | 0.194 \*\*\* |  |
| Hispanic\_T2 |  |  | -0.065 |  |
| jan\_2015:Asian\_T3 |  | -0.066 |  |  |
| jan\_2015:Black\_T3 |  | -0.045 |  |  |
| jan\_2015:Hispanic\_3 |  | 0.209 |  |  |
| Asian\_T3 |  | 0.035 |  |  |
| Black\_T3 |  | 0.246 \*\*\* |  |  |
| Hispanic\_T3 |  | 0.02 |  |  |
| R2 | 0.7035 | 0.7363 | 0.7344 | 0.6965 |
| Adjusted R2 | 0.6956 | 0.7204 | 0.7183 | 0.6877 |
| Number of Observations | 2361 | 1108 | 1108 | 2361 |
| F Statistic | 88.91\*\*\* | 46.18\*\*\* | 45.73\*\*\* | 79.27\*\*\* |

Once again the conditions the conditions for Black showed negative correlation in all models.

The most interesting findings Hispanic T1 is as shown before once again positively correlated. Nevertheless, the most interesting of all is that the interaction terms of Asian T2, Asian T1 and Black T1 with after 2015 are all positively significant.

5. Dicsussion

1. Personal identity theory does not lead to increase in performance films not clear from diversity not significant. It is not a good measurement. It does not have a positive effect on films

What must be said is that this can also be caused because the sources which the films derive from also have new releases. If a new Batman comic book is released people might think of watching the film again. Also is important that when the film is based on a play this effect is negative.

Main effect: These findings suggest that higher diversity, as measured by the inverse Simpson diversity index, tends to be linked with lower popularity, signifying a potential inverse relationship between diversity and the ranking.

This somewhat contradictory with previous research (Kuppuswamy, 2016) who found a significant positive result between a film having multiple black actors and box office. They concluded that the amount of Black actors was positively correlated with Domestic box office and positively with World- Wide box office.

This negative correlation can have two causes.

Moreover, Hall 2022 found that people do generate more engagement with films that have characters with similar traits. There was research providing evidence for positive correlation with racial diversity and box office revenue. The finding of this model suggest that including people from different ethnicities might provide inclusion for the people who are now included but it might cause other demographics not being represented. Simply said if we would take race and age as two characteristics and you have two characters we keep everything else constant. Because the population in the states is still mostly white by removing certain characters because they are replaced by coloured actors etc.

Nevertheless, the reason can also as found by (Aumer, 2017) that there might be no preference for watching ourselves on the screen. 18 50, Hispanic , White

Aumer 2017 Look at the paper once again. Proofing no support for social identity theory.

Main points :   
AIR increases the explanatory power. Nevertheless, this is in a different group of sample. When Simpson diversity used on this sample the R2 squared (0.7158) and R2 adjusted (0.7005) increase. Where the Simpson diversity index has not a significant effect (β = 0.184 , p = 0.102) Therefore, the model is better in explaining this specific sample but there is something going on.

Moreover, this also shows that the inverted Simpson diversity index is not robust. While T1 remains significant in the entire dataset and solely the dataset used for mediation analysis. Nevertheless, this is a negative effect for the black ethnicity and almost a significant effect for Hispanic ethnicity.

But with all levels of T the black ethnicity remains to have negative effect.

Moreover AIR 2 and 3 are a bit arbitrary.

AIR 1 is better than racial diversity with the same sample.

Diversity solely not a proper measurement. AIR is indeed can be seen as a positive effect. And it compensates for the negative effect of diversity which positively influences AIR. So focus on AIR not diversity.

Nevertheless, this phenomenon has only appeared in the last few years and the positive effect might wonder off. Trend of more budget,

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Appendix A: Stop word list

Appendix B: Subtitle files parching

I cleaned the subtitle files and applied a logic for scene identification. In these subtitle files, when it's unclear who is speaking, the person is identified and labeled (e.g., "QUEEN GORGO"), referred to in the datasets as the "speaker." To ascertain the individuals in the scenes, I employed the en\_core\_web\_md model from the spaCy Natural Language package, which can recognize entities in the text.

To identify scenes, I wrote code which went through the subtitle file and looked for pauses in dialogue. If a pause exceeded five seconds, the code identified it as a new scene. I chose five seconds because it allows the audience to mentally adjust to the new scene without disrupting the narrative flow. Because this is a threshold, even if a scene switch took longer, I would still be counted it as one scene switch.

Next, I conducted a fuzzy merge with a thrershold of 0.85, aligning the character list with their respective ethnicities within the dataset.

Appendix C : multicollinearity matrix

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| LTAE = 1 Sequal = 2 Spinoff = 3 (B) Book = 4 (B) Play = 5 (B) C = 6 (B) CB = 7 (B) Novel = 8 (B) Short = 9 SI = 10 | Action = 11 Adventure = 12 Comedy = 13 Fantasy = 14 Crime = 15 Drama = 16 Mystery = 17 Thriller = 18 Romance = 19 Sci.Fi = 20 | Biography = 21 Sport = 22 War = 23 Family = 24 Musical = 25 History = 26 Horror = 27 Documentary = 28 Western = 29 2000 = 30 | 2001 = 31 2002 = 32 2003 = 33 2004 = 34 2005 = 35 2006 = 36 2007 = 37 2008 = 38 2009 = 39 2010 = 40 | 2011 = 41 2012 = 42 2013 = 43 2014 = 44 2015 = 45 2016 = 46 2017 = 47 2018 = 48 2019 = 49 (L)Nominee = 50 | Winner = 51 Remake = 52 D\_power = 53 (L)Metscore = 54 (L) Str power = 55 Spring = 56 Summer = 57 Fall = 58 Winter = 59 |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| LTAE | 1.00 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Sequal | -0.07 | 1.00 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Spinoff | -0.02 | 0.01 | 1.00 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| (B) Book | -0.02 | -0.05 | -0.03 | 1.00 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| (B) Play | -0.03 | -0.02 | -0.01 | -0.02 | 1.00 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| (B) C | -0.10 | 0.04 | 0.09 | -0.04 | -0.02 | 1.00 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| (B) CB | -0.13 | 0.02 | 0.06 | -0.06 | -0.02 | 0.71 | 1.00 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| (B) Novel | -0.10 | -0.04 | -0.04 | 0.08 | 0.03 | -0.07 | -0.09 | 1.00 |  |  |  |  |  |  |  |  |  |  |  |  |
| (B) Short | -0.03 | -0.02 | -0.01 | -0.02 | -0.01 | -0.02 | -0.02 | -0.04 | 1.00 |  |  |  |  |  |  |  |  |  |  |  |
| SI | 0.12 | 0.06 | 0.06 | -0.04 | -0.06 | 0.06 | 0.06 | -0.11 | -0.02 | 1.00 |  |  |  |  |  |  |  |  |  |  |
| Action | -0.15 | 0.14 | 0.05 | -0.07 | -0.01 | 0.25 | 0.35 | -0.03 | -0.02 | 0.23 | 1.00 |  |  |  |  |  |  |  |  |  |
| Adventure | -0.14 | 0.26 | 0.10 | -0.02 | -0.01 | 0.23 | 0.27 | 0.06 | -0.02 | 0.06 | 0.41 | 1.00 |  |  |  |  |  |  |  |  |
| Comedy | 0.04 | -0.05 | -0.06 | -0.01 | 0.01 | -0.08 | -0.06 | -0.08 | -0.04 | -0.02 | -0.25 | -0.11 | 1.00 |  |  |  |  |  |  |  |
| Fantasy | -0.07 | 0.02 | -0.03 | -0.06 | -0.03 | 0.08 | 0.14 | 0.11 | 0.00 | -0.03 | 0.08 | 0.23 | 0.00 | 1.00 |  |  |  |  |  |  |
| Crime | -0.04 | -0.06 | -0.05 | -0.02 | -0.04 | -0.03 | -0.02 | -0.01 | 0.01 | 0.07 | 0.08 | -0.19 | -0.06 | -0.16 | 1.00 |  |  |  |  |  |
| Drama | 0.10 | -0.17 | -0.10 | 0.12 | 0.07 | -0.09 | -0.16 | 0.15 | 0.03 | -0.09 | -0.26 | -0.26 | -0.24 | -0.13 | 0.10 | 1.00 |  |  |  |  |
| Mystery | 0.01 | -0.03 | 0.03 | -0.01 | -0.03 | -0.07 | -0.05 | 0.07 | 0.05 | -0.08 | -0.12 | -0.10 | -0.24 | 0.00 | 0.07 | 0.01 | 1.00 |  |  |  |
| Thriller | -0.08 | 0.02 | -0.01 | -0.02 | -0.04 | -0.03 | -0.03 | 0.00 | 0.04 | 0.07 | 0.27 | -0.05 | -0.47 | -0.14 | 0.31 | 0.01 | 0.34 | 1.00 |  |  |
| Romance | -0.06 | -0.12 | -0.03 | 0.02 | 0.10 | -0.09 | -0.12 | 0.09 | 0.01 | -0.14 | -0.28 | -0.17 | 0.30 | 0.00 | -0.18 | 0.13 | -0.15 | -0.30 | 1.00 |  |
| Sci.Fi | -0.11 | 0.09 | 0.07 | -0.06 | -0.04 | 0.23 | 0.33 | -0.01 | 0.12 | 0.12 | 0.38 | 0.38 | -0.18 | 0.05 | -0.19 | -0.21 | -0.01 | 0.02 | -0.16 | 1.00 |
| Biography | 0.09 | -0.06 | -0.04 | 0.24 | -0.02 | -0.05 | -0.07 | -0.07 | -0.02 | -0.08 | -0.14 | -0.09 | -0.15 | -0.08 | 0.01 | 0.30 | -0.10 | -0.12 | -0.03 | -0.12 |
| Sport | 0.05 | -0.03 | -0.03 | 0.07 | 0.04 | -0.04 | -0.06 | -0.06 | -0.02 | -0.03 | -0.10 | -0.06 | -0.02 | -0.08 | -0.08 | 0.16 | -0.09 | -0.16 | -0.01 | -0.09 |
| War | 0.01 | -0.02 | -0.03 | 0.08 | 0.16 | 0.01 | -0.03 | 0.06 | -0.02 | -0.06 | 0.07 | 0.04 | -0.12 | -0.04 | -0.06 | 0.19 | -0.05 | -0.03 | -0.03 | -0.06 |
| Family | 0.09 | 0.03 | -0.03 | 0.03 | -0.03 | -0.06 | -0.09 | 0.13 | -0.03 | -0.06 | -0.14 | 0.24 | 0.20 | 0.36 | -0.14 | -0.11 | -0.06 | -0.24 | 0.00 | -0.03 |
| Musical | 0.03 | 0.10 | 0.01 | -0.03 | 0.17 | -0.02 | -0.03 | 0.02 | -0.01 | -0.06 | -0.09 | 0.02 | 0.05 | 0.07 | -0.03 | 0.01 | -0.04 | -0.08 | 0.08 | -0.06 |
| History | 0.04 | -0.04 | -0.03 | 0.10 | 0.16 | -0.04 | -0.05 | 0.03 | -0.02 | -0.13 | -0.03 | -0.05 | -0.11 | -0.08 | -0.05 | 0.21 | -0.09 | -0.09 | -0.04 | -0.09 |
| Horror | 0.03 | -0.02 | 0.03 | -0.02 | -0.03 | -0.03 | -0.02 | -0.09 | -0.03 | -0.04 | -0.13 | -0.15 | -0.24 | 0.02 | -0.12 | -0.17 | 0.41 | 0.27 | -0.18 | 0.05 |
| Documentary | 0.30 | -0.02 | 0.04 | -0.01 | -0.01 | -0.01 | -0.02 | -0.03 | -0.01 | 0.05 | -0.05 | -0.03 | 0.03 | -0.03 | -0.03 | -0.06 | -0.03 | -0.05 | -0.03 | -0.03 |
| Western | -0.02 | -0.02 | -0.01 | 0.03 | -0.01 | 0.03 | 0.05 | 0.04 | -0.01 | -0.02 | 0.10 | 0.07 | -0.03 | 0.05 | -0.04 | 0.00 | -0.04 | 0.03 | 0.00 | -0.02 |
| 2000 | -0.05 | -0.04 | -0.01 | 0.03 | -0.01 | -0.04 | -0.05 | -0.01 | -0.01 | -0.09 | -0.03 | 0.00 | 0.05 | -0.03 | 0.01 | 0.02 | -0.04 | -0.01 | 0.03 | 0.01 |
| 2001 | -0.08 | -0.02 | 0.00 | -0.01 | -0.02 | -0.04 | -0.04 | 0.01 | 0.08 | -0.02 | -0.05 | -0.06 | 0.02 | -0.04 | 0.05 | -0.02 | 0.01 | 0.02 | 0.05 | 0.00 |
| 2002 | -0.06 | 0.05 | -0.01 | 0.05 | -0.02 | -0.02 | -0.02 | 0.05 | 0.04 | -0.02 | 0.00 | 0.00 | 0.02 | -0.03 | 0.04 | 0.02 | 0.08 | 0.04 | -0.03 | -0.02 |
| 2003 | -0.07 | 0.00 | 0.00 | -0.01 | -0.02 | -0.02 | -0.02 | -0.03 | -0.02 | -0.03 | 0.00 | -0.04 | 0.08 | 0.01 | 0.00 | -0.05 | -0.02 | -0.03 | -0.02 | -0.04 |
| 2004 | -0.06 | -0.04 | -0.03 | -0.03 | 0.04 | 0.02 | 0.01 | 0.03 | -0.02 | -0.06 | -0.05 | -0.03 | 0.03 | -0.03 | 0.02 | -0.02 | 0.01 | -0.05 | 0.04 | 0.00 |
| 2005 | -0.05 | -0.02 | -0.01 | 0.00 | -0.01 | 0.01 | 0.01 | 0.01 | -0.02 | -0.04 | 0.01 | 0.06 | 0.01 | 0.03 | -0.02 | -0.02 | 0.00 | 0.01 | 0.02 | -0.03 |
| 2006 | -0.06 | 0.00 | 0.01 | -0.03 | 0.09 | -0.04 | -0.04 | -0.03 | -0.02 | -0.04 | -0.03 | -0.05 | 0.00 | -0.01 | 0.05 | -0.01 | -0.02 | 0.01 | 0.01 | -0.04 |
| 2007 | -0.05 | -0.02 | -0.03 | -0.02 | -0.02 | -0.02 | -0.02 | -0.01 | -0.02 | -0.04 | -0.07 | -0.06 | -0.02 | -0.01 | 0.08 | 0.03 | 0.01 | 0.09 | -0.03 | -0.07 |
| 2008 | -0.08 | 0.00 | -0.03 | -0.02 | -0.02 | 0.08 | 0.06 | 0.00 | -0.02 | -0.08 | 0.02 | -0.02 | 0.01 | 0.03 | -0.03 | 0.01 | -0.05 | -0.03 | 0.06 | -0.02 |
| 2009 | -0.07 | 0.00 | 0.02 | 0.05 | -0.02 | -0.01 | -0.02 | -0.01 | 0.03 | -0.08 | -0.05 | -0.01 | -0.01 | 0.05 | -0.03 | 0.01 | 0.02 | -0.03 | 0.04 | 0.01 |
| 2010 | -0.04 | 0.00 | 0.01 | -0.02 | -0.02 | 0.01 | 0.04 | 0.01 | 0.03 | -0.05 | 0.01 | -0.03 | 0.05 | 0.07 | 0.00 | -0.03 | -0.01 | -0.03 | 0.06 | -0.03 |
| 2011 | -0.05 | 0.02 | -0.03 | 0.03 | 0.06 | 0.00 | 0.02 | 0.03 | 0.02 | -0.09 | 0.00 | 0.00 | 0.01 | 0.02 | -0.07 | -0.03 | 0.01 | -0.02 | 0.04 | -0.02 |
| 2012 | -0.01 | 0.02 | 0.04 | -0.02 | 0.07 | -0.03 | -0.02 | 0.02 | 0.02 | -0.03 | 0.01 | 0.01 | 0.00 | -0.04 | -0.04 | 0.00 | -0.03 | -0.02 | 0.00 | 0.01 |
| 2013 | 0.02 | 0.01 | -0.02 | 0.00 | -0.02 | 0.01 | 0.04 | 0.00 | -0.02 | 0.02 | 0.03 | -0.01 | -0.02 | -0.04 | 0.06 | 0.00 | -0.04 | 0.04 | -0.05 | -0.01 |
| 2014 | 0.09 | 0.00 | 0.02 | -0.02 | -0.02 | -0.01 | 0.01 | 0.04 | 0.01 | 0.04 | 0.05 | 0.03 | -0.05 | 0.02 | 0.00 | 0.00 | 0.02 | -0.02 | -0.04 | 0.01 |
| 2015 | 0.05 | 0.01 | 0.01 | -0.04 | -0.02 | -0.01 | -0.02 | -0.05 | -0.02 | 0.03 | 0.04 | 0.03 | -0.01 | -0.05 | 0.00 | 0.04 | 0.01 | 0.00 | -0.02 | 0.04 |
| 2016 | 0.09 | -0.05 | -0.02 | -0.01 | -0.01 | -0.03 | -0.02 | -0.03 | -0.01 | 0.07 | 0.02 | -0.01 | -0.02 | 0.03 | 0.00 | 0.01 | -0.04 | 0.01 | -0.03 | 0.04 |
| 2017 | 0.08 | -0.02 | -0.03 | 0.01 | -0.01 | -0.01 | 0.03 | 0.01 | -0.01 | 0.11 | -0.01 | 0.03 | -0.05 | 0.05 | -0.04 | 0.03 | -0.01 | -0.02 | -0.02 | 0.06 |
| 2018 | 0.21 | 0.01 | 0.05 | 0.04 | -0.02 | 0.01 | 0.01 | -0.01 | -0.02 | 0.20 | 0.06 | 0.07 | -0.05 | -0.03 | 0.01 | -0.02 | 0.02 | 0.05 | -0.07 | 0.08 |
| 2019 | 0.13 | 0.05 | 0.02 | 0.02 | -0.02 | 0.09 | 0.04 | -0.05 | -0.02 | 0.16 | 0.01 | 0.04 | -0.05 | 0.00 | -0.07 | 0.04 | 0.05 | -0.02 | -0.05 | 0.02 |
| (L)Nominee | -0.38 | 0.18 | 0.07 | 0.06 | 0.06 | 0.17 | 0.23 | 0.05 | 0.03 | -0.03 | 0.11 | 0.26 | -0.18 | 0.10 | -0.03 | 0.00 | -0.01 | -0.03 | -0.07 | 0.20 |
| Winner | -0.29 | 0.14 | 0.02 | 0.05 | 0.07 | 0.15 | 0.17 | 0.09 | 0.01 | -0.03 | 0.06 | 0.22 | -0.16 | 0.09 | -0.05 | 0.04 | -0.02 | -0.04 | -0.05 | 0.14 |
| Remake | -0.03 | -0.08 | -0.02 | -0.05 | 0.02 | -0.02 | -0.05 | -0.07 | -0.02 | -0.03 | -0.03 | -0.04 | -0.04 | 0.02 | 0.03 | -0.04 | 0.01 | 0.04 | 0.00 | -0.01 |
| D\_power | -0.17 | 0.11 | 0.04 | -0.02 | 0.08 | 0.12 | 0.14 | 0.07 | 0.02 | 0.02 | 0.09 | 0.20 | -0.08 | 0.11 | 0.02 | -0.05 | -0.02 | -0.01 | -0.05 | 0.08 |
| (L)Metscore | -0.33 | 0.10 | 0.02 | 0.07 | 0.04 | 0.06 | 0.08 | 0.06 | 0.04 | 0.03 | 0.04 | 0.09 | -0.11 | -0.01 | 0.05 | 0.17 | -0.04 | 0.02 | -0.04 | 0.06 |
| (L) Str power | -0.17 | 0.04 | 0.08 | -0.05 | -0.02 | 0.15 | 0.16 | -0.05 | 0.00 | 0.07 | 0.16 | 0.16 | -0.03 | 0.04 | 0.00 | -0.08 | -0.05 | -0.01 | -0.03 | 0.12 |
| Spring | 0.01 | -0.01 | 0.03 | -0.01 | -0.02 | 0.05 | 0.05 | -0.02 | -0.03 | 0.02 | 0.01 | 0.02 | 0.01 | -0.03 | -0.01 | 0.01 | -0.01 | -0.05 | 0.05 | 0.07 |
| Summer | -0.01 | -0.01 | 0.01 | -0.02 | -0.02 | 0.07 | 0.09 | -0.06 | 0.04 | 0.05 | 0.10 | 0.07 | 0.08 | -0.01 | -0.06 | -0.15 | -0.04 | -0.03 | -0.04 | 0.10 |
| Fall | 0.03 | 0.04 | -0.05 | 0.02 | 0.03 | -0.09 | -0.10 | 0.04 | 0.00 | -0.01 | -0.08 | -0.09 | -0.06 | -0.02 | 0.05 | 0.10 | 0.05 | 0.04 | -0.06 | -0.12 |
| Winter | -0.03 | -0.02 | 0.01 | 0.00 | 0.01 | -0.03 | -0.04 | 0.04 | -0.02 | -0.06 | -0.03 | 0.00 | -0.04 | 0.07 | 0.02 | 0.04 | 0.00 | 0.05 | 0.05 | -0.05 |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 22 | 23 | 24 | 2 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 |
| Biography | 1.00 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Sport | 0.26 | 1.00 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| War | 0.06 | -0.02 | 1.00 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Family | -0.05 | 0.02 | -0.05 | 1.00 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Musical | 0.00 | -0.03 | 0.01 | 0.19 | 1.00 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| History | 0.34 | 0.05 | 0.42 | -0.07 | 0.01 | 1.00 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Horror | -0.10 | -0.09 | -0.03 | -0.10 | -0.03 | -0.08 | 1.00 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Music | 0.08 | -0.04 | -0.01 | 0.04 | 0.13 | 0.01 | -0.08 | 1.00 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Documentary | -0.02 | -0.01 | -0.01 | -0.02 | -0.01 | 0.06 | -0.03 | 0.13 | 1.00 |  |  |  |  |  |  |  |  |  |  |  |  |
| Western | 0.02 | 0.03 | 0.14 | -0.03 | -0.01 | 0.03 | -0.01 | -0.02 | -0.01 | 1.00 |  |  |  |  |  |  |  |  |  |  |  |
| 2000 | -0.03 | 0.04 | -0.01 | 0.01 | -0.02 | -0.01 | -0.03 | -0.01 | -0.01 | -0.02 | 1.00 |  |  |  |  |  |  |  |  |  |  |
| 2001 | -0.04 | -0.05 | 0.02 | -0.01 | -0.03 | -0.02 | -0.02 | 0.00 | -0.01 | -0.02 | -0.04 | 1.00 |  |  |  |  |  |  |  |  |  |
| 2002 | -0.04 | -0.02 | 0.01 | 0.02 | 0.01 | -0.02 | -0.04 | 0.03 | -0.01 | -0.02 | -0.04 | -0.05 | 1.00 |  |  |  |  |  |  |  |  |
| 2003 | -0.04 | 0.00 | 0.01 | 0.02 | 0.01 | 0.01 | 0.02 | -0.02 | -0.01 | 0.03 | -0.04 | -0.05 | -0.04 | 1.00 |  |  |  |  |  |  |  |
| 2004 | 0.01 | 0.04 | 0.00 | 0.05 | 0.01 | 0.04 | 0.02 | 0.05 | -0.01 | 0.07 | -0.04 | -0.05 | -0.05 | -0.04 | 1.00 |  |  |  |  |  |  |
| 2005 | 0.03 | 0.05 | -0.01 | 0.02 | 0.01 | 0.04 | -0.01 | 0.04 | 0.06 | 0.09 | -0.03 | -0.04 | -0.04 | -0.04 | -0.04 | 1.00 |  |  |  |  |  |
| 2006 | 0.03 | 0.04 | -0.02 | 0.00 | 0.01 | 0.06 | -0.01 | -0.02 | -0.01 | -0.02 | -0.04 | -0.05 | -0.05 | -0.04 | -0.05 | -0.04 | 1.00 |  |  |  |  |
| 2007 | 0.02 | 0.00 | 0.08 | 0.01 | 0.01 | 0.03 | 0.02 | -0.02 | -0.01 | -0.02 | -0.04 | -0.04 | -0.04 | -0.04 | -0.04 | -0.04 | -0.04 | 1.00 | 1.00 |  |  |
| 2008 | -0.01 | 0.01 | 0.01 | -0.01 | -0.03 | 0.01 | -0.01 | -0.03 | -0.02 | -0.02 | -0.04 | -0.05 | -0.05 | -0.05 | -0.05 | -0.04 | -0.05 | -0.05 | -0.06 | 1.00 |  |
| 2009 | 0.06 | 0.01 | -0.03 | -0.01 | -0.03 | 0.01 | 0.00 | 0.02 | -0.02 | -0.02 | -0.04 | -0.05 | -0.05 | -0.05 | -0.05 | -0.04 | -0.05 | -0.05 | -0.06 | -0.06 | 1.00 |
| 2010 | -0.06 | -0.05 | -0.01 | 0.03 | -0.03 | -0.03 | -0.01 | -0.01 | -0.02 | 0.02 | -0.04 | -0.05 | -0.05 | -0.05 | -0.05 | -0.05 | -0.05 | -0.05 | -0.07 | -0.07 | -0.07 |
| 2011 | -0.03 | 0.01 | -0.02 | 0.01 | -0.01 | 0.00 | 0.00 | -0.02 | 0.03 | 0.01 | -0.05 | -0.06 | -0.06 | -0.06 | -0.06 | -0.05 | -0.06 | -0.06 | -0.06 | -0.06 | -0.06 |
| 2012 | -0.02 | 0.02 | 0.03 | 0.00 | 0.03 | -0.01 | -0.02 | 0.01 | -0.02 | 0.02 | -0.05 | -0.06 | -0.05 | -0.05 | -0.05 | -0.05 | -0.06 | -0.05 | -0.06 | -0.06 | -0.06 |
| 2013 | 0.03 | -0.01 | -0.03 | -0.07 | 0.00 | -0.05 | -0.01 | -0.01 | 0.04 | 0.02 | -0.04 | -0.05 | -0.05 | -0.05 | -0.05 | -0.05 | -0.05 | -0.05 | -0.07 | -0.07 | -0.07 |
| 2014 | 0.09 | 0.00 | 0.02 | -0.02 | -0.02 | -0.01 | 0.01 | 0.04 | 0.01 | 0.04 | 0.05 | 0.03 | -0.05 | 0.02 | 0.00 | 0.00 | 0.02 | -0.02 | -0.04 | 0.01 | 0.02 |
| 2015 | 0.05 | 0.01 | 0.01 | -0.04 | -0.02 | -0.01 | -0.02 | -0.05 | -0.02 | 0.03 | 0.04 | 0.03 | -0.01 | -0.05 | 0.00 | 0.04 | 0.01 | 0.00 | -0.02 | 0.04 | 0.00 |
| 2016 | 0.09 | -0.05 | -0.02 | -0.01 | -0.01 | -0.03 | -0.02 | -0.03 | -0.01 | 0.07 | 0.02 | -0.01 | -0.02 | 0.03 | 0.00 | 0.01 | -0.04 | 0.01 | -0.03 | 0.04 | -0.02 |
| 2017 | 0.08 | -0.02 | -0.03 | 0.01 | -0.01 | -0.01 | 0.03 | 0.01 | -0.01 | 0.11 | -0.01 | 0.03 | -0.05 | 0.05 | -0.04 | 0.03 | -0.01 | -0.02 | -0.02 | 0.06 | 0.01 |
| 2018 | 0.21 | 0.01 | 0.05 | 0.04 | -0.02 | 0.01 | 0.01 | -0.01 | -0.02 | 0.20 | 0.06 | 0.07 | -0.05 | -0.03 | 0.01 | -0.02 | 0.02 | 0.05 | -0.07 | 0.08 | 0.04 |
| 2019 | 0.13 | 0.05 | 0.02 | 0.02 | -0.02 | 0.09 | 0.04 | -0.05 | -0.02 | 0.16 | 0.01 | 0.04 | -0.05 | 0.00 | -0.07 | 0.04 | 0.05 | -0.02 | -0.05 | 0.02 | 0.03 |
| Nominee | -0.38 | 0.18 | 0.07 | 0.06 | 0.06 | 0.17 | 0.23 | 0.05 | 0.03 | -0.03 | 0.11 | 0.26 | -0.18 | 0.10 | -0.03 | 0.00 | -0.01 | -0.03 | -0.07 | 0.20 | 0.08 |
| Winner | -0.29 | 0.14 | 0.02 | 0.05 | 0.07 | 0.15 | 0.17 | 0.09 | 0.01 | -0.03 | 0.06 | 0.22 | -0.16 | 0.09 | -0.05 | 0.04 | -0.02 | -0.04 | -0.05 | 0.14 | 0.09 |
| Remake | -0.03 | -0.08 | -0.02 | -0.05 | 0.02 | -0.02 | -0.05 | -0.07 | -0.02 | -0.03 | -0.03 | -0.04 | -0.04 | 0.02 | 0.03 | -0.04 | 0.01 | 0.04 | 0.00 | -0.01 | -0.06 |
| (L) D power | -0.17 | 0.11 | 0.04 | -0.02 | 0.08 | 0.12 | 0.14 | 0.07 | 0.02 | 0.02 | 0.09 | 0.20 | -0.08 | 0.11 | 0.02 | -0.05 | -0.02 | -0.01 | -0.05 | 0.08 | -0.03 |
| (L) Metscore | -0.33 | 0.10 | 0.02 | 0.07 | 0.04 | 0.06 | 0.08 | 0.06 | 0.04 | 0.03 | 0.04 | 0.09 | -0.11 | -0.01 | 0.05 | 0.17 | -0.04 | 0.02 | -0.04 | 0.06 | 0.11 |
| (L) Str power | -0.17 | 0.04 | 0.08 | -0.05 | -0.02 | 0.15 | 0.16 | -0.05 | 0.00 | 0.07 | 0.16 | 0.16 | -0.03 | 0.04 | 0.00 | -0.08 | -0.05 | -0.01 | -0.03 | 0.12 | -0.05 |
| Spring | 0.01 | -0.01 | 0.03 | -0.01 | -0.02 | 0.05 | 0.05 | -0.02 | -0.03 | 0.02 | 0.01 | 0.02 | 0.01 | -0.03 | -0.01 | 0.01 | -0.01 | -0.05 | 0.05 | 0.07 | -0.04 |
| Summer | -0.01 | -0.01 | 0.01 | -0.02 | -0.02 | 0.07 | 0.09 | -0.06 | 0.04 | 0.05 | 0.10 | 0.07 | 0.08 | -0.01 | -0.06 | -0.15 | -0.04 | -0.03 | -0.04 | 0.10 | -0.05 |
| Fall | 0.03 | 0.04 | -0.05 | 0.02 | 0.03 | -0.09 | -0.10 | 0.04 | 0.00 | -0.01 | -0.08 | -0.09 | -0.06 | -0.02 | 0.05 | 0.10 | 0.05 | 0.04 | -0.06 | -0.12 | 0.06 |
| Winter | -0.03 | -0.02 | 0.01 | 0.00 | 0.01 | -0.03 | -0.04 | 0.04 | -0.02 | -0.06 | -0.03 | 0.00 | -0.04 | 0.07 | 0.02 | 0.04 | 0.00 | 0.05 | 0.05 | -0.05 | 0.03 |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | 62 |
| 2010 | 1.00 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2011 | -0.07 | 1.00 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2012 | -0.06 | -0.07 | 1.00 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2013 | -0.06 | -0.07 | -0.06 | 1.00 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2014 | -0.07 | -0.08 | -0.07 | -0.07 | 1.00 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2015 | -0.06 | -0.07 | -0.06 | -0.06 | -0.07 | 1.00 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2016 | -0.04 | -0.05 | -0.04 | -0.04 | -0.05 | -0.04 | 1.00 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2017 | -0.04 | -0.05 | -0.05 | -0.04 | -0.05 | -0.04 | -0.03 | 1.00 |  |  |  |  |  |  |  |  |  |  |  |  |
| 2018 | -0.07 | -0.08 | -0.07 | -0.07 | -0.08 | -0.07 | -0.05 | -0.05 | 1.00 |  |  |  |  |  |  |  |  |  |  |  |
| 2019 | -0.06 | -0.07 | -0.06 | -0.06 | -0.07 | -0.06 | -0.04 | -0.04 | -0.07 | 1.00 |  |  |  |  |  |  |  |  |  |  |
| Nominee | -0.01 | 0.02 | -0.01 | 0.01 | -0.01 | 0.01 | 0.00 | 0.00 | 0.05 | 0.04 | 1.00 |  |  |  |  |  |  |  |  |  |
| Winner | -0.03 | -0.01 | -0.01 | -0.01 | 0.03 | 0.01 | 0.02 | -0.02 | 0.05 | 0.04 | 0.81 | 1.00 |  |  |  |  |  |  |  |  |
| Remake | -0.01 | -0.04 | -0.05 | 0.00 | -0.03 | -0.02 | -0.05 | -0.05 | 0.01 | 0.04 | 0.02 | 0.03 | 1.00 |  |  |  |  |  |  |  |
| (L) D power | 0.01 | 0.01 | -0.01 | -0.01 | 0.00 | -0.02 | -0.02 | 0.00 | 0.01 | 0.01 | 0.37 | 0.39 | -0.02 | 1.00 |  |  |  |  |  |  |
| (L) Metscore | -0.03 | -0.01 | 0.01 | 0.03 | -0.01 | 0.00 | 0.03 | 0.00 | 0.03 | 0.03 | 0.53 | 0.46 | -0.02 | 0.19 | 1.00 |  |  |  |  |  |
| (L) Str power | 0.02 | -0.04 | -0.03 | -0.01 | -0.02 | 0.00 | 0.02 | 0.04 | -0.01 | 0.02 | 0.23 | 0.19 | -0.01 | 0.23 | 0.14 | 1.00 |  |  |  |  |
| Spring | 0.03 | -0.01 | -0.05 | -0.01 | -0.05 | 0.03 | -0.07 | 0.10 | -0.01 | 0.01 | 0.01 | -0.02 | 0.04 | -0.06 | 0.03 | -0.01 | 1.00 |  |  |  |
| Summer | -0.01 | -0.05 | 0.02 | 0.00 | 0.00 | 0.06 | -0.06 | -0.07 | 0.04 | 0.00 | 0.05 | 0.07 | 0.00 | 0.06 | 0.03 | 0.05 | -0.36 | 1.00 |  |  |
| Fall | 0.00 | 0.06 | -0.01 | 0.04 | -0.02 | -0.06 | 0.09 | -0.05 | 0.01 | -0.01 | -0.03 | -0.03 | -0.04 | -0.03 | 0.02 | -0.06 | -0.35 | -0.36 | 1.00 |  |
| Winter | -0.03 | 0.00 | 0.04 | -0.03 | 0.07 | -0.03 | 0.05 | 0.02 | -0.05 | 0.00 | -0.03 | -0.02 | 0.00 | 0.02 | -0.09 | 0.01 | -0.30 | -0.31 | -0.30 | 1.00 |

Appendix D VIF values models:

|  |  |
| --- | --- |
| Variable | VIF value |
| simpson\_index | 1.23 |
| log(boxofficemojo.com\_openingtheaters) | 2.11 |
| log(imdb.com\_runtime) | 1.93 |
| log\_MPAA | 2.13 |
| log(average\_budget) | 2.63 |
| log\_sequel | 1.21 |
| imdb.com\_spinoff | 1.06 |
| log\_remake | 1.09 |
| imdb.com\_basedonbook | 1.09 |
| imdb.com\_basedonplay | 1.06 |
| imdb.com\_basedoncomicbook | 1.30 |
| imdb.com\_basedonnovel | 1.17 |
| imdb.com\_basedonshortstory | 1.05 |
| log\_Nominee | 1.30 |
| log\_Winner | 1.31 |
| log\_dir\_power | 1.62 |
| log\_metascore | 1.10 |
| log\_starpower | 1.37 |
| Action | 2.00 |
| Adventure | 1.69 |
| Comedy | 2.09 |
| Fantasy | 1.35 |
| Crime | 1.45 |
| Drama | 1.72 |
| Mystery | 1.37 |
| Thriller | 2.02 |
| Romance | 1.40 |
| Sci.Fi | 1.48 |
| Biography | 1.42 |
| Sport | 1.23 |
| War | 1.24 |
| Family | 2.05 |
| Musical | 1.08 |
| History | 1.36 |
| Horror | 1.78 |
| Music | 1.16 |
| Documentary | 1.19 |
| Western | 1.04 |
| Spring | 1.64 |
| Summer | 1.66 |
| Fall | 1.65 |
| `2001` | 1.97 |
| `2002` | 1.96 |
| `2003` | 1.94 |
| `2004` | 2.02 |
| `2005` | 2.09 |
| `2006` | 2.16 |
| `2007` | 2.10 |
| `2008` | 2.06 |
| `2009` | 2.02 |
| `2010` | 1.99 |
| `2011` | 2.02 |
| `2012` | 1.90 |
| `2013` | 1.93 |
| `2014` | 2.02 |
| `2015` | 1.94 |
| `2016` | 2.20 |
| `2017` | 1.95 |
| `2018` | 2.19 |
| `2019` | 2.00 |

ViF values three regression models

|  |  |  |  |
| --- | --- | --- | --- |
| **Variable:** | **Black** | **Asian** | **Hispanic** |
| **SI** | 1.30 | 1.46 | 1.38 |
| **Opening screens** | 2.14 | 2.13 | 2.21 |
| **Log(Runtime)** | 2.33 | 2.58 | 2.49 |
| **Log(MPAA)** | 2.21 | 2.17 | 2.14 |
| **Log(Average\_Budget** | 3.73 | 4.15 | 3.93 |
| **log\_sequel** | 1.31 | 1.30 | 1.25 |
| **imdb.com\_spinoff** | 1.10 | 1.23 | 1.13 |
| **log\_remake** | 1.12 | 1.16 | 1.14 |
| **imdb.com\_basedonbook** | 1.17 | 1.28 | 1.15 |
| **imdb.com\_basedonplay** | 1.00 | 1.00 | 1.00 |
| **imdb.com\_basedoncomic** | 2.02 | 2.58 | 1.76 |
| **imdb.com\_basedoncomicbook** | 2.38 | 2.78 | 2.10 |
| **imdb.com\_basedonnovel** | 1.16 | 1.28 | 1.18 |
| **imdb.com\_basedonshortstory** | 1.00 | 1.24 | 1.00 |
| **log\_Nominee** | 4.14 | 4.27 | 4.16 |
| **log\_Winner** | 3.47 | 3.41 | 3.40 |
| **log\_dir\_power** | 1.39 | 1.44 | 1.32 |
| **log\_metascore** | 1.57 | 1.69 | 1.61 |
| **log\_starpower** | 1.27 | 1.48 | 1.34 |
| **Action** | 2.41 | 2.62 | 2.45 |
| **Adventure** | 2.03 | 2.30 | 2.34 |
| **Comedy** | 2.03 | 2.23 | 1.99 |
| **Fantasy** | 1.42 | 1.73 | 1.54 |
| **Crime** | 1.58 | 1.45 | 1.62 |
| **Drama** | 1.92 | 2.05 | 2.09 |
| **Mystery** | 1.39 | 1.50 | 1.44 |
| **Thriller** | 2.16 | 2.18 | 2.20 |
| **Romance** | 1.43 | 1.26 | 1.41 |
| **Sci.Fi** | 1.71 | 1.89 | 1.79 |
| **Biography** | 1.61 | 1.75 | 1.62 |
| **Sport** | 1.44 | 1.37 | 1.38 |
| **War** | 1.36 | 1.45 | 1.44 |
| **Family** | 2.22 | 2.57 | 2.23 |
| **Musical** | 1.23 | 1.25 | 1.12 |
| **History** | 1.47 | 1.76 | 1.92 |
| **Horror** | 1.86 | 1.99 | 1.87 |
| **Music** | 1.28 | 1.24 | 1.38 |
| **Documentary** | 1.00 | 1.00 | 1.00 |
| **Western** | 1.15 | 1.00 | 1.00 |
| **Spring** | 2.00 | 1.95 | 1.69 |
| **Summer** | 2.06 | 2.02 | 1.78 |
| **Fall** | 1.96 | 1.71 | 1.82 |
| **`2001`** | 2.39 | 1.00 | 4.53 |
| **`2002`** | 2.59 | 2.63 | 2.86 |
| **`2003`** | 2.32 | 2.01 | 1.00 |
| **`2004`** | 2.04 | 2.03 | 2.89 |
| **`2005`** | 1.91 | 1.45 | 3.65 |
| **`2006`** | 2.71 | 2.72 | 5.57 |
| **`2007`** | 2.42 | 2.06 | 2.90 |
| **`2008`** | 2.59 | 1.43 | 3.80 |
| **`2009`** | 2.39 | 2.08 | 5.89 |
| **`2010`** | 2.26 | 1.00 | 4.62 |
| **`2011`** | 2.36 | 2.14 | 6.27 |
| **`2012`** | 2.46 | 2.82 | 2.02 |
| **`2013`** | 2.75 | 2.42 | 5.33 |
| **`2014`** | 3.44 | 2.48 | 10.36 |
| **`2015`** | 2.82 | 2.77 | 7.35 |
| **`2016`** | 2.12 | 2.36 | 3.62 |
| **`2017`** | 2.50 | 2.45 | 3.69 |
| **`2018`** | 4.58 | 4.68 | 12.47 |
| **`2019`** | 4.10 | 3.45 | 7.56 |

Appendix D: Entire main regression analysis

|  |  |  |  |
| --- | --- | --- | --- |
|  | Coefficient | **Robust.SE** | Sign |
| (Intercept) | 18.7634364 | 0.6172377 | < 0.001 \*\*\* |
| Inverse Simpson index | 0.2788352 | 0.0854869 | < 0.001 \*\*\* |
|  |  |  |  |
| Log\_screens | -0.4607796 | 0.0508223 | < 0.001 \*\*\* |
| Log runtime | -1.3511415 | 0.1143878 | < 0.001 \*\*\* |
| log\_MPAA | -0.7109994 | 0.0729009 | < 0.001 \*\*\* |
| Log\_average\_budget | -0.0470878 | 0.0171892 | 0.008 |
| log\_sequel | 0.0058112 | 0.0014671 | < 0.001 \*\*\* |
| spinoff | -0.0564512 | 0.0420592 | 0.203 |
| log\_remake | 0.0035104 | 0.0017161 | 0.063 |
| basedonbook | -0.1316908 | 0.0615430 | 0.034 |
| basedonplay | 0.3750325 | 0.1386266 | 0.012 |
| basedoncomic | -0.0560893 | 0.1070822 | 0.590 |
| basedoncomicbook | -0.3142000 | 0.0785232 | < 0.001 \*\*\* |
| basedonnovel | -0.1080797 | 0.0352643 | 0.002 |
| basedonshortstory | -0.0100308 | 0.1037285 | 0.936 |
| log\_Nominee | -0.0091412 | 0.0016273 | < 0.001 \*\*\* |
| log\_Winner | -0.0143761 | 0.0011203 | < 0.001 \*\*\* |
| log\_dir\_power | -0.0096619 | 0.0016879 | < 0.001 \*\*\* |
| log\_metascore | -0.0355427 | 0.0082175 | < 0.001 \*\*\* |
| log\_starpower | -0.0038060 | 0.0018459 | 0.032 |
| Action | -0.0410699 | 0.0345181 | 0.247 |
| Adventure | -0.1351720 | 0.0358245 | < 0.001 \*\*\* |
| Comedy | 0.1301336 | 0.0383721 | < 0.001 \*\*\* |
| Fantasy | -0.0493828 | 0.0369585 | 0.220 |
| Crime | 0.0458143 | 0.0361069 | 0.205 |
| Drama | 0.1486707 | 0.0320064 | < 0.001 \*\*\* |
| Mystery | -0.0519966 | 0.0383778 | 0.187 |
| Thriller | 0.0376747 | 0.0337026 | 0.282 |
| Romance | -0.0847929 | 0.0367200 | 0.013 |
| Sci.Fi | -0.1089913 | 0.0372327 | 0.006 |
| Biography | 0.1629182 | 0.0625266 | 0.006 |
| Sport | 0.1355867 | 0.0636215 | 0.025 |
| War | 0.1428677 | 0.0705197 | 0.043 |
| Family | 0.2083408 | 0.0534861 | < 0.001 \*\*\* |
| Musical | -0.2922735 | 0.1308821 | 0.007 |
| History | 0.1588541 | 0.0690280 | 0.028 |
| Horror | 0.0693812 | 0.0452779 | 0.126 |
| Music | 0.0622507 | 0.0674210 | 0.325 |
| Documentary | 0.7488378 | 0.1260843 | < 0.001 \*\*\* |
| Western | 0.4924241 | 0.1199375 | < 0.001 \*\*\* |
| Spring | 0.0167648 | 0.0346022 | 0.629 |
| Summer | -0.0165910 | 0.0351252 | 0.635 |
| Fall | 0.0425621 | 0.0344176 | 0.214 |
| 2001 | -0.0835118 | 0.0841020 | 0.271 |
| 2002 | 0.0797040 | 0.0809338 | 0.296 |
| 2003 | 0.0671009 | 0.0822956 | 0.384 |
| 2004 | -0.0175361 | 0.0869597 | 0.816 |
| 2005 | 0.1337888 | 0.0785376 | 0.074 |
| 2006 | 0.0907173 | 0.0785327 | 0.219 |
| 2007 | 0.1149531 | 0.0726303 | 0.126 |
| 2008 | 0.0317699 | 0.0826234 | 0.673 |
| 2009 | 0.1722148 | 0.0772681 | 0.023 |
| 2010 | 0.2008708 | 0.0787402 | 0.009 |
| 2011 | 0.3513528 | 0.0799067 | < 0.001 \*\*\* |
| 2012 | 0.5024574 | 0.0793373 | < 0.001 \*\*\* |
| 2013 | 0.6166931 | 0.0823798 | < 0.001 \*\*\* |
| 2014 | 0.7911409 | 0.0847740 | < 0.001 \*\*\* |
| 2015 | 0.7911298 | 0.0807096 | < 0.001 \*\*\* |
| 2016 | 0.8791387 | 0.0790009 | < 0.001 \*\*\* |
| 2017 | 0.8228709 | 0.0901873 | < 0.001 \*\*\* |
| 2018 | 1.0214914 | 0.0841829 | < 0.001 \*\*\* |
| 2019 | 0.9679212 | 0.0984391 | < 0.001 \*\*\* |

Text removed:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Variable | Coefficient | Sign |  | Variable | Coefficient | Sign |
| Hispanic\_t3 | 0.07 | 0.23 |  | *Family* | 0.25 | < 0.001 \*\*\* |
| Black\_ t3 | 0.25 | < 0.001 \*\*\* |  | *Music* | 0.26 | 0.002\*\* |
| Asian \_t3 | 0.04 | 0.53 |  | *Documentary* | 0.94 | < 0.001 \*\*\* |
| Log(Screens) | -0.49 | < 0.001 \*\*\* |  | *Western* | 0.47 | 0.005\*\* |
| Log(Runtime) | -0.75 | < 0.001 \*\*\* |  | *`2002`* | 0.25 | 0.028\* |
| Log(MPAA) | -0.53 | < 0.001 \*\*\* |  | *`2004`* | 0.08 | 0.030\* |
| Log(Average budget) | -0.05 | 0.049\* |  | *`2005`* | 0.27 | 0.020\* |
| Log(Sequel) | 0.02 | 0.008\*\* |  | *`2007`* | 0.27 | 0.015\* |
| Based on play | 0.41 | 0.045\* |  | *`2009`* | 0.28 | 0.009\*\* |
| Based on comic book | -0.20 | 0.004\*\* |  | *`2010`* | 0.48 | < 0.001 \*\*\* |
| Based on Novel | -0.12 | 0.006\*\* |  | *`2011`* | 0.53 | < 0.001 \*\*\* |
| log(Nominee) | -0.16 | < 0.001 \*\*\* |  | *`2012`* | 0.65 | < 0.001 \*\*\* |
| log(Winner) | -0.15 | < 0.001 \*\*\* |  | *`2013`* | 0.80 | < 0.001 \*\*\* |
| log(dirpower) | -0.82 | < 0.001 \*\*\* |  | *`2014`* | 0.89 | < 0.001 \*\*\* |
| log(metascore) | -0.34 | < 0.001 \*\*\* |  | *`2015`* | 0.87 | < 0.001 \*\*\* |
| Comedy | 0.14 | 0.001\*\* |  | *`2016`* | 1.07 | < 0.001 \*\*\* |
| Drama | 0.14 | < 0.001 \*\*\* |  | *`2017`* | 0.98 | < 0.001 \*\*\* |
| Romance | -0.15 | < 0.001 \*\*\* |  | *`2018`* | 1.19 | < 0.001 \*\*\* |
| Biography | 0.29 | < 0.001 \*\*\* |  | *`2019`* | 1.09 | < 0.001 \*\*\* |
| R2 | 0.7355 |  |  | Adj R2 | 0.7208 |  |
| F Statistic | 49.93\*\*\* | (df = 62; 1113) |  |  |  |  |

1. IMDb's user base is 62% male, which is comparable to the gender distribution of ticket sales (59% male). In terms of age distribution, which can be seen in Figure 2 and 3, IMDb's demographics align with those of filmgoers, except that older age groups are underrepresented on IMDb (MPAA, 2022; Similaweb, 2023).

   Moreover, IMDb's user base is predominantly American, according to Similarweb's 2023 data. Nevertheless, given the study's focus on the Hollywood film industry and the cultural nuances of racial representation, it makes sense to focus on the United States for the analysis. The results can potentially be transferred to countries with a similar cultural landscape and other demographic similarities with the United States. [↑](#footnote-ref-1)
2. Online streaming services have made it easier for people to watch older films, which has helped to maintain their popularity. As of October 2023, films such as Inglourious Basterds (2009), The Da Vinci Code (2006), and L.A. Confidential (1997) are all listed on Netflix's "Popular on Netflix" tab. This increased competition can make it more difficult for newer films to gain traction, especially those that fall outside of the "blockbuster" category. In the past, less popular new films only had to compete with the few hundred films available in a movie store; now, they have to compete with thousands of films offered on online streaming platforms. [↑](#footnote-ref-2)
3. In the complete dataset, 15% of individuals linked to characters did not have associated images. Among unique actors and actresses, this figure increased to 28%. Meaning that people without images were more likely to play fewer roles. [↑](#footnote-ref-3)
4. Previous data showed that imageless characters tended to play fewer roles. The filtering process showed that imageless characters were also more likely to play less prominent characters. After the filter for generic names, 77% of characters without images were removed, compared to 66% of characters with images.

   This suggests that named characters were mostly played by people with images. As a result, the percentage of characters that were assigned an ethnicity through their name instead of facial recognition decreased from 15% to 11% of the dataset after filtering for non-named characters. As a result, imageless people are also more likely to play characters that were not authentic and inclusive (AIR). This suggests that filtering for AIR characters might also include filtering for characters played by people without images. This is an area for further exploration. [↑](#footnote-ref-4)
5. The awards used in this research are the following: Academy Awards, Critics’ Choice Awards, Directors Guild Awards, Golden Globe Awards, Golden Laurel Awards, Independent Spirit Awards, Los Angeles Film Association Awards, MTV Awards, National Board of Review Awards, National Society of Film Critics Awards, New York Film Critics Circle Awards, People’s Choice Awards and the Screen Actors Guild Awards. [↑](#footnote-ref-5)
6. Two significant factors have demonstrated influencing racial diversity in previous research. In 2019, action films exhibited a notably higher likelihood of including characters from underrepresented racial and ethnic groups. Additionally, films with larger budgets tend to have more diverse casts, as they possess greater resources to hire a wide range of actors (Smith, 2020). [↑](#footnote-ref-6)
7. This correlation pattern is explicable, as substantial budgets are often associated with large-scale blockbusters, while lower-budget films tend to have more restrained advertising budgets (Kumar, 2022).

   Furthermore, the correlation between advertising expenses and the number of screens is pronounced enough to be considered substitutes, suggesting that a considerable production budget is linked to an extensive advertising budget, and the advertising budget and number of screens are interchangeable (Hennig-Thurau, Housten, and Walsh, 2007).

   It is also understandable that longer films would require or receive a larger production budget. Finally, Adventure films, due to their frequent need for extensive location shooting and elaborate special effects. This is also shown with the genre ‘Action’ also exhibiting a relatively high correlation with average budget (0.46). [↑](#footnote-ref-7)
8. This relationship was also demonstrated in (Prag and Casavant, 1994), which showed that star power was positively related to production budget and marketing expenditures. Production companies such as Disney likely see it as a less financial risk to invest in successful directors, leading them to invest in screens for these films as well. [↑](#footnote-ref-8)