



# The Black Lives Matter movement mitigates bias against racial minority actors

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Watching movies is among the most popular entertainment and cultural activities. How do viewers react when a movie sequel increases racial minority actors in the main cast (“minority increase”)? On the one hand, such sequels may receive better evaluations if viewers appreciate racially inclusive casting for its novel elements (the value-in-diversity perspective) and moral appeal (the fairness perspective on diversity). On the other hand, discrimination research suggests that if viewers harbor biases against racial minorities, sequels with minority increase may receive worse evaluations. To examine these competing possibilities, we analyze a unique panel dataset of movie series released from 1998 to 2021 and conduct text analysis of 312,457 reviews of these movies. Consistent with discrimination research, we find that movies with minority increase receive lower ratings and more toxic reviews. Importantly, these effects weaken after the advent of the Black Lives Matter (BLM) movement, especially when the movement’s intensity is high. These results are reliable across various robustness checks (e.g., propensity score matching, random implementation test). We conceptually replicate the bias mitigation effect of BLM in a preregistered experiment: Heightening the salience of BLM increases White individuals’ acceptance of racial minority increase in a movie sequel. This research demonstrates the power of social movements in fostering diversity, equality, and inclusion.

diversity, equality, and inclusion (DEI) | racial bias | Black Lives Matter | social movement | culture

Racial inequality is a perennial issue in society (1, 2), evident not only in economic disparities (3) but also in the marginalization of minorities in sociocultural activities, such as the underrepresentation of racial minority actors in movies—one of the most popular forms of entertainment and cultural activities (4). Policymakers, social commentators, and academics have been calling for more racially inclusive casting in the movie industry (5). But do movie viewers react favorably to increased racial minority presence in movies? Further complicating this question is the changing landscape of racial relations in society. With the rise of social movements like Black Lives Matter (BLM) advocating for racial equality, how may viewers’ attitudes change toward minority presence on the silver screen? Answering these questions not only has important business implications but also contributes to our understanding of diversity, equality, and inclusion (DEI) practices in the context of social change.

To address the above questions, we focus on a noteworthy context of racial minority representation: the increase in racial minority actors in the main cast of a sequel movie relative to the preceding movie in the same series (henceforth “minority increase”). Following the consensus in screenwriting (6), we operationalize the main cast as the top three roles in a movie. We focus on minority presence in these starring roles because they are the most important characters, are often featured prominently in marketing materials (e.g., centered positions on posters), and can influence movie evaluation (7).

We examine the context of movie series for both its economic and theoretical significance. Economically, movie series can reach large-scale viewership over an extended period of time, capturing an increasingly popular market. The average annual box-office revenue for movie series increased more than tenfold to \$8.1 billion annually in 2019 (8), compared to \$718 million in the 1990s (9). Theoretically, studying audience reactions to minority presence in film provides a real-world opportunity to probe “modern” discrimination. With legislation outlawing overt forms of racial discrimination (e.g., racial segregation), racial prejudice has become harder to detect (10). By examining potential racial biases in movie ratings and reviews, we tackle covert forms of racial prejudice that may go unnoticed.

Moreover, the context of movie series affords an opportunity to connect diversity research to broader theoretical discourses on business (i.e., product change) and society (i.e., social change). In a movie franchise, minority increase in movie sequels can be viewed as an important form of product change (9). As we elaborate below, varied theoretical

## Significance

Diversity, equality, and inclusion (DEI) are critical societal issues. How do viewers react when a movie sequel increases racial minority actors in the main cast? We analyze a unique dataset of movie series released from 1998 to 2021 and conduct text analysis of 312,457 reviews of these movies. We find that increasing minority actors predicts lower movie ratings and more toxic language in movie reviews. These effects weaken after the advent of the Black Lives Matter (BLM) movement, especially when the movement’s intensity is high. We conceptually replicate this bias mitigation effect of BLM in a preregistered experiment, further demonstrating the power of social movements in fostering DEI.

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perspectives diverge in their predictions of how movie viewers will react to such a change. On the one hand, sequels with minority increase may receive better evaluations if viewers appreciate racially inclusive casting for its novel elements (the value-in-diversity perspective) and moral appeal (the fairness perspective on diversity). On the other hand, discrimination research suggests that if viewers harbor biases against racial minorities, sequels with minority increase may receive worse evaluations.

Adding to these competing possibilities, both organization scholars (11) and marketing scholars (12) have noted the importance of social context in legitimizing change: Whether a change in product or practice (in our context, minority increase) is accepted depends on not only the properties of the change itself, but also the broader sociocultural environment that shapes people's attitudes and expectations. To examine the role of the evolving social context of race, we focus on BLM, one of the most thematically representative and largest-scale social movements propelling changes in racial relations.

In the next section, we first discuss different theoretical perspectives on how minority increase may affect audience evaluations of movies. We then discuss how the BLM movement may shape the link between minority increase and audience evaluations.

**1.1. Why Viewers May React Positively to Minority Increase in Movie Sequels.** The value-in-diversity perspective and the fairness perspective (13, 14) both suggest that the audience may react favorably toward minority increase. The value-in-diversity perspective champions the inclusion of minorities on the basis of its instrumental benefits (14, 15). Supporting this view, some studies have found that due to racial minority members' unique skills and perspectives (16), racially diverse groups tend to be more productive and creative than racially homogenous ones (17, 18).

In the creative industry of movie making, the creative potential afforded by a racially inclusive cast can be especially appealing. Marketing scholars posit that for experiential and intangible products like movies, consumers prefer to experience novelty and variety (19). In movie series wherein an initial story is extended into follow-up shows (i.e., sequels), dissimilar extensions (e.g., new characters and storylines) are often preferred to similar ones (9). Thus, to the extent that a racially diverse cast stimulates new elements in a movie, viewers seeking novelty may react favorably to movies with minority increase.

In addition to the value-in-diversity perspective, the fairness perspective posits that diversity is desired for its intrinsic value of social justice (14). Indeed, racial inclusivity is often seen as a moral obligation and "the right thing to do" (20). Research on social cause marketing postulates that, driven by a desire to affirm their moral self-views (21), consumers tend to support products that they believe have positive moral value (22). In line with this view, movie viewers may perceive racial inclusivity as a step toward the morally valuable goal of racial equality, and thus favorably evaluate movies with minority increase.

In sum, both the value-in-diversity perspective and the fairness perspective suggest that minority increase may positively affect movie evaluations. In contrast to this view, discrimination research points to the opposite possibility, as we elaborate next.

**1.2. Why Viewers May React Negatively to Minority Increase in Movie Sequels.** Discrimination research (23) has revealed biases against racial minorities across a variety of settings, including the sales of memorabilia (24), attendance at sporting events (25), and investment in entrepreneurial projects (26). In a similar vein, preliminary empirical research suggests that movie viewing

is also likely subject to racial biases. Using fictitious scenarios, lab experiments find that White participants show less interest in watching movies with more (vs. fewer) Black cast members (27). In the context of TV viewing, televised sports shows receive higher viewership when featuring more White (vs. minority) players (28), an effect that persists after controlling for audience demographics and player performance.

Notably, racial bias can be categorized into two types: taste-based bias and statistical bias. Taste-based bias (29) concerns the audience's prejudicial distaste for racial minorities irrespective of their performance credentials. Statistical bias, on the other hand, concerns how perceived group-level attributes may be used to justify differential treatments (30, 31). For example, some argue that bank clerks rationally offer different interest rates to borrowers of different races, not because of bank clerks' racial preferences, but because of racial differences in repayment rates (32). Here, race may be a surrogate for "characteristics which in fact cause the productivity differences" (30).

In our context, statistical bias may manifest if, net of other factors, viewers downrate movies that add minority actors with low-performance credentials (e.g., ratings of the actors' previous movies). However, if adding high-credentialed minority actors still lowers movie ratings, it would point to viewers' prejudicial distaste for racial minorities. Also, viewers with taste-based prejudice may express their distaste for minorities by leaving racially hostile and toxic reviews on movie review sites. In sum, racial discrimination theories suggest that due to viewers' potential racial bias (whether taste-based or statistical), viewers may react negatively to minority increase in movie sequels.

**1.3. How the BLM Movement May Shape Viewers' Reaction to Minority Increase in Movie Sequels.** So far, we have discussed the competing theoretical possibilities on how viewers may react to minority increase in movie sequels. What may further complicate the question is the changing social context of race. Indeed, past research suggests that social attitudes toward minorities are not static; rather, they are sensitive to changes in the macrosocial environment punctuated by high-salience events such as civic unrest and collective actions (33–35). We therefore posit that the extent to which minority increase is perceived (un)favorably can be influenced by the prevailing social environment. To examine the role of the social context of race, we focus on BLM, one of the largest-scale social movements seeking racial equality.

BLM's thematic focus on antiracism, as manifested in its distinct mottos and policy issues, distinguishes it from previous racial justice movements (36). Moreover, different from social movements that operate in a traditional offline environment, BLM leverages new media technologies (e.g., Twitter) that provide new ways to amplify its influence. Digital activism, a common component in contemporary social movements, empowers collective actions with cost-effective networks, interpretive framing, and repertoires of protest action (37). These advantages of new media engagement allow BLM to mobilize wide audiences and coordinate efforts on an unprecedented "mega-event" scale (33).

For example, between 1 June 2014, and 31 May 2015, over 4.4 million users contributed over 40 million tweets referencing BLM-related keywords (38). Following the police killing of George Floyd in 2020, BLM garnered a record 8.8 million social media posts in a single day (39). As evidence of allyship from the business community, 31% of Fortune 100 companies showed their support for racial minorities by posting black squares on their social media accounts (40). Concurrent with its wide online impact, BLM has been linked to observable changes in real life. With protests spreading across major US cities, BLM has been found to promote Black

political institutions (41), reduce police use of lethal force (42), and increase voter support for policies and candidates advocating for racial equality (43, 44). Beyond the political sphere, national surveys indicate that individuals' self-reported racial attitudes have become more progressive post-BLM than pre-BLM (35, 45).

The above discussions suggest that BLM has effectuated meaningful shifts in racial relations to mitigate racial biases (35, 45), supporting the possibility that after (vs. before) BLM, viewers will respond more positively to movies with minority increase.

Meanwhile, it is also possible that BLM may trigger a backlash, leading some viewers to reject rather than welcome minority increase. This possibility is grounded in concerns with performative progressivism, or support for social justice causes that is cosmetic and superficial rather than facilitating structural change (46). In the context of BLM, actions supporting racial equality can be deemed performative, criticized, and resented for their shallowness and inauthenticity (46). Similarly, in movies, viewers may perceive the inclusion of racial minorities as a form of virtue signaling that creates the optics of equality while evading deeper systemic problems of discrimination (47, 48). To the extent that the antiracism culture catalyzed by BLM sensitizes the audience by raising their suspicions about the "just for show" motives behind minority increase (46), audience concerns and distaste for performative progressivism may loom larger post-BLM, resulting in an evaluation penalty for movies with minority increase (i.e., the backlash effect).

The two arguments above point to opposite predictions and highlight the need to empirically examine how BLM moderates the link between minority increase and movie evaluations.

**1.4. Theoretical Clarifications.** Our paper examines movie viewers' attitudes toward racial minority presence in films. While we acknowledge that both viewers and actors come from diverse racial backgrounds, for the purpose of our paper, we focus on White viewers' attitudes toward non-White actors. Besides the empirical reasons elaborated in Section 2 (e.g., the majority of expert movie reviews are from White individuals), our focus on non-White actors is motivated by the following theoretical reasons. First, theories of racial discrimination have focused on majority–minority intergroup processes as the drivers of racial biases (49). People of color (e.g., Black, Asian, Hispanic), with their shared vulnerabilities in social standing, can be viewed as sharing the racial status of "the minority" (50, 51). In line with the literature framing racial dynamics around the majority–minority relations (52), we focus on the majority's (i.e., White people's) attitudes toward the minority's (i.e., non-White actors') presence in movies.

Second, the social movement literature finds that welfare advocacy for one minority group can spill over to promote culturally progressive dialogues about other minority groups as well (53). In particular, BLM has been found to catalyze inclusion initiatives that benefit both Black and non-Black racial minorities (e.g., Asians, Hispanics) (54). These discussions suggest that it is useful to consider not only Black actors but also non-Black minority actors. Thus, our key phenomenon of interest, minority increase, encompasses all minority racial groups. To explore potential heterogeneity within the minority groups, we conduct additional analysis considering Black actors and non-Black minority actors separately (*SI Appendix*).

## 2. Study Overview

Table 1 summarizes our empirical analyses. In Part 1, we analyze movie ratings from Rotten Tomatoes (RT) experts at the movie level. For robustness, we include RT audience rating and Internet

Movie Database (IMDb) audience rating as additional outcomes. Applying difference-in-differences (DID) estimation to a dataset of 435 movies nested in 173 series released between 1998 and 2021, we find that minority increase in the main cast of a movie series negatively predicts movie ratings on both RT and IMDb. Importantly, this negative association weakens after the advent of BLM. We interpret these results as supporting BLM's bias mitigation effect (as opposed to a backlash effect). Furthermore, this bias mitigation effect is stronger when BLM's level of public engagement (i.e., intensity) is higher.

Part 2 substantiates the movie-level analysis by conducting text analysis at the movie-review level. Applying natural language processing (NLP) algorithms to 312,457 anonymous movie reviews on IMDb, we find that sequels with minority increase are more likely to receive toxic reviews. Consistent with Part 1, we find that the relationship between minority increase and review toxicity weakens after the advent of BLM, especially when the movement's intensity is high. The review-level analysis thus further corroborates BLM's bias mitigation effect.

As discussed earlier, we focus on the White audience's reactions to non-White presence in movies. White individuals are the numerical majority in the United States. Manual coding of a RT subsample with discernible racial identity reveals that 85% of the expert reviews were written by White individuals. Analyzing this sample of reviews written by White individuals, we find substantively similar patterns of results (*SI Appendix*) as those reported in the main text.

Supplementing the archival analyses, in Part 3 we conduct a preregistered experiment to directly test the causal impact of BLM on White audience's acceptance of minority increase. Recruiting a sample of White participants in the United States, the experiment provides causal evidence that increasing the salience of BLM leads White participants to give higher ratings to a sequel movie that added a racial minority actor in its main cast, an effect mediated by favorable attitudes toward the racial minority actor. The experiment therefore conceptually replicates the bias mitigation effect of BLM documented in Parts 1 and 2.

## 3. Part 1: Analyses at the Movie Level

**3.1. Data.** We collect data from RT and IMDb to construct a panel dataset of movie series. IMDb and RT were launched in 1990 and 1998, respectively. To preclude the concern about the audience's potential biases when evaluating movies with established reputations, we focus on the period after the launch of these review sites (55). Our sample period therefore starts in 1998 (i.e., the year RT was launched) and ends in 2021.

### 3.2. Variables.

**3.2.1. Predictor variable.** Our predictor is the change-oriented action of minority increase. We compare a focal movie relative to the preceding movie in the same series to determine whether there is an increase in the number of minority actors in the main cast. Following the consensus in screenwriting (6), we define the main cast as the top three lead roles and operationalize it as the three actors designated as "stars" on a movie's IMDb page.

The variable "minority increase" takes the value of 1 after a series increases the number of racial minority actors in its main cast; the variable takes the value of 0 prior to the increase. Following best practices to identify race (56), we collect and triangulate actor race information from multiple sources.\* Among all main cast actors,

\*Sources of race information for main cast members include IMDb, Wikipedia, Sticky Facts (<https://thestickyfacts.com/>), the Notable Names Database (<https://www.nndb.com/>), Know Size (<https://www.knowsize.com/index/celebrity/>), and Ethnicity of Celebs (<https://ethnical-cebs.com/>).

**Table 1. Overview of key results**

Aim	Analysis	Predictor	Key findings	Interpretation
<b>The main effect of minority increase</b> Strengthen causal inference for the main effect of minority increase	DID estimation	Minority increase	Minority increase negatively predicts movie ratings.	The audience is biased against movies with minority increase.
	Parallel trends assumption test		There is no pre-treatment difference in movie rating trend between the control group (i.e., series without minority increase) and the treatment group (i.e., series with minority increase).	The negative relationship between minority increase and movie ratings is not driven by differential trends between the treatment and control groups of movies before minority increase.
	Random implementation test	Random implementations of minority increase	The average estimated effect of minority increase based on random treatment is not statistically different from zero. The likelihood of obtaining an estimate similar to the actual one by chance is very low.	The negative relationship between minority increase and movie ratings is not an artifact of idiosyncrasies associated with movie series that experienced minority increase.
	Propensity score matching	Minority increase	Among matched series, minority increase negatively predicts movie ratings.	The negative relationship between minority increase and movie ratings is not caused by differences in matched aspects of the movies.
	Analyzing both minority increase and decrease	Minority <i>change</i> (1 = movies with minority increase; 2 = movies with minority decrease; 0 = movies without minority change)	Minority increase negatively predicts movie ratings, whereas minority decrease does not significantly predict movie ratings.	The negative relationship between minority increase and movie ratings is robust after accounting for minority decrease.
<b>The interaction effect of minority increase and BLM</b>	DID estimation	Minority increase × BLM	BLM positively moderates the relationship between minority increase and movie ratings.	BLM mitigates the bias against minorities, such that the negative relationship between minority increase and movie ratings weakens after (vs. before) BLM.
Alternative operationalization of BLM (as the movement's intensity)	DID estimation with alternative operationalization of BLM (as the movement's intensity)	Minority increase × BLM intensity	BLM intensity positively moderates the relationship between minority increase and movie ratings.	BLM mitigates the bias against minorities, such that the negative relationship between minority increase and movie ratings is weaker when BLM's intensity is higher (vs. lower).
Whether the bias mitigation effect of BLM applies to both Black and non-Black minority actors	DID estimation	Minority increase × BLM (Minority increase is categorized into two types: when the added minority actor is Black and when the added minority actor is non-Black)	BLM positively moderates the relationship between minority increase and movie ratings both when the added minority actor is Black and when the added minority actor is non-Black.	BLM mitigates the bias against not only Black actors but also non-Black minority actors.
Rule out the alternative explanation that minority increase negatively predicts movie ratings because the audience dislikes cast change per se	Comparing minority increase to (a) White cast change without minority increase and (b) no cast change	Cast change type × BLM (Type 1: movies with cast change and minority increase. Type 2: movies with cast change but without minority increase [i.e., a White actor replacing a White actor]. Type 0: movies without cast change)	Before BLM, Type 1 movies receive significantly lower ratings than both Type 2 and Type 0 movies. After BLM, Type 1 movies no longer receive significantly lower ratings than either Type 2 or Type 0 movies.	The negative relationship between minority increase and movie ratings cannot be explained by cast change per se. BLM uniquely benefits movies with minority increase.

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**Table 1.** (Continued)

Aim	Analysis	Predictor	Key findings	Interpretation
Rule out the alternative explanation that minority increase negatively predicts movie ratings because the added minority actors have lower credentials	Comparing (a) movies that added high-credentialed minorities and (b) movies that added low-credentialed minorities to (c) movies without minority increase	High/low-credentialed minority increase $\times$ BLM (an actor's credential = the average ratings of all the movies the actor had received credit for prior to joining a focal movie. Minority actors are split into high/low-credentialed groups if their credentials are higher/lower than the sample mean)	Before BLM, minority increase negatively predicts movie ratings when the added minority actors are either high- or low-credentialed.  After BLM, minority increase no longer predicts movie ratings when the added minority actors are either high- or low-credentialed.	The bias against minority actors cannot be explained by differences in actor credentials, suggesting that the audience likely harbors taste-based bias against minorities.  BLM mitigates taste-based bias against minorities.
	Comparing (a) movies that replaced White actors with higher-credentialed minorities and (b) movies that replaced White actors with lower-credentialed minorities to (c) movies without minority increase	Higher/lower-credentialed minority increase $\times$ BLM (Minority actors are split into higher/ lower-credentialed groups if their credentials are higher/lower than the White actors that they replaced)	Before BLM, minority increase negatively predicts movie ratings when the added minority actors are either higher- or lower-credentialed.  After BLM, minority increase no longer predicts movie ratings when the added minority actors are either higher- or lower-credentialed.	The bias against minority actors cannot be explained by differences in actor credentials, suggesting that the audience likely harbors taste-based bias against minorities.  BLM mitigates taste-based bias against minorities.

Note 1. Outcomes = Movie ratings (RT expert rating, RT audience rating, IMDb audience rating).

Note 2. Minority increase is defined as increasing the number of racial minority actors in the main cast (i.e., the top three roles designated as "stars" by IMDb) in a movie sequel relative to the preceding movie of the same series.

Note 3. Boldface indicates main analysis categories.

78% are White, 9% are Black, 3% are Asian, 2% are Hispanic, and the remaining are other minorities or multiracial. Actors are categorized into three broader racial groups: White, Black, and other minorities.

**3.2.2. Outcome variables.** Our outcome variables are each movie's numeric ratings aggregated and published by movie review sites: a) RT expert rating, b) RT audience rating, and c) IMDb audience rating. RT expert rating is based on movie reviews from accredited media outlets and critics societies and has been widely used as a measure of public reception of movies (55, 57). Following the literature, we use RT expert rating as our main outcome variable. As robustness checks, we use RT audience rating and IMDb audience rating as additional outcome variables. As detailed below, results are consistent across the three ratings.

**3.2.3. Moderator.** Following the literature that dates the advent of BLM to 2013 (33), we measure BLM as a binary variable that takes the value of 0 if a movie was released before 2013, and one otherwise. Dividing the observation period into before and after BLM's year of advent aligns with established practices, as 2013 is a pivotal year for the movement's emergence and growth (35, 45). This approach is also consistent with the recommendations in the literature to define the impact horizon of an event by its time of inception (58–60). To account for the dynamic nature of BLM, we also quantify the intensity of BLM by measuring its level of public engagement in both the online (e.g., volume of tweets) and the offline (e.g., number of protests) settings (Section 3.3.2.3). We obtain consistent results with both the binary measure and the continuous measure of BLM.

**3.2.4. Controls.** The panel structure of the dataset allows us to include a) year fixed effects to control for unobserved time-varying effects (e.g., macroeconomic conditions) and b) movie series fixed effects to control for series-specific characteristics (e.g., series fame). Thus, we only need to further control for potential confounding factors that may correlate with both minority increase and movie ratings and that may vary simultaneously across time and series. Informed by prior movie studies (55, 57), we include a comprehensive list of control variables:

First, for each main cast member we collect a) the average RT expert rating of the movies in which they had participated and b) the number of award nominations they had received, prior to joining the focal movie. For each of these two measures, we take the average across the three main cast members to create a movie-level control of main cast prior records. Second, we control for a) the average RT expert rating and b) the nomination count for the director of each movie to account for the director's prior records. Third, we control for a) the average RT expert rating and b) the nomination count for the screenwriters of each movie to account for the screenwriters' prior records.<sup>†</sup>

Fourth, we control for the total number of actors (i.e., full cast size) in each movie to account for potential cast size enlargement that may co-occur with minority increase. Fifth, we control for the number of female actors in the main cast to account for potential gender effects. Sixth, we control for the production budget of each movie (log transformed). Seventh, we control for movie genres

<sup>†</sup>When a focal movie is an actor/director/writer's first movie (i.e., no prior record), we follow the literature (55, 75, 76) and use the mean value of the rest of the sample. Results are robust when using multiple imputation or listwise deletion (SI Appendix).

following the classification of the Motion Picture Association of America. Eighth, the level of market competition may affect cast selection and movie ratings, so we construct a variable competition by counting the number of movies belonging to the same genre(s) released in the same year. Ninth, we control for movie distributors.

**3.3. Empirical Strategies and Results.** *SI Appendix, Table S1* presents descriptive statistics and bivariate correlations among the variables.

**3.3.1. Main effect: minority increase negatively predicts movie ratings.** We use a DID estimation to model the effect of minority increase on movie ratings. The DID estimation method is widely used in contexts similar to ours (61). A DID model estimates the effect of the treatment (minority increase) on an outcome (movie ratings) by comparing a) the average change over time in the outcome variable for the treatment group to b) the average change over time in the outcome for the control group. Eq. 1 presents the estimation specification.

*SI Appendix, Table S2* presents the regression results as specified in Eq. 1. Each Model 1 presents baseline results without control variables. Each Model 2 presents results with all control variables. The coefficients of minority increase are significant and negative across all three movie ratings: After the number of minority main cast members increases, movie ratings on average decrease by 6.5 out of 100 points in RT expert rating, 4.4 out of 100 points in RT audience rating, and 0.29 out of 10 points in IMDb audience rating.

To validate our findings, we perform a battery of robustness checks. First, we conduct a parallel trends assumption test to rule out the concern that the observed negative relationship between minority increase and movie ratings is merely because sequel movies are generally inferior in ratings compared to the preceding movies (*SI Appendix, section 1.1*). Second, we conduct a random implementation test to rule out the possibility that the observed negative relationship between minority increase and movie ratings is merely an artifact of the idiosyncrasies associated with movie series that experienced minority increase, rather than the result of minority increase itself (*SI Appendix, section 1.2*). Third, we conduct a propensity score matching analysis to show that the findings are not driven by systematic differences in observable characteristics between the series that experienced minority increase and the series that did not (*SI Appendix, section 1.3*). Fourth, we conduct instrumental variable analyses using three different instruments to address endogeneity concerns with unobserved confounding factors (*SI Appendix, section 1.4*). Fifth, we use a non-DID based, alternative model specification to consider both minority increase and minority decrease (i.e., sequels having fewer minority main cast members than the preceding movies), finding that the negative link between minority increase and movie ratings remains robust after accounting for minority decrease (*SI Appendix, section 1.5*).

**3.3.2. Moderation effect: BLM mitigates the negative relationship between minority increase and movie ratings.** We have theorized that BLM has the potential to mitigate racial bias, leading movie viewers to react more positively to minority increase after (vs. before) the advent of BLM (i.e., the bias mitigation effect). Conversely, BLM may lead to aversive reactions to minority increase if concerns about performative progressivism prevail (i.e., the backlash effect). Empirically, we examine these possibilities by testing whether and how BLM moderates the link between minority increase and movie ratings as detailed in Eq. 2. The BLM variable takes the value of 0 if movie  $j$  in series  $i$  was released before 2013, and 1 otherwise. Among the 435 movies, 279 movies were released before the advent of BLM, and 156 were released after.

As exhibited in *SI Appendix, Table S3*, regressions reveal a significant and positive interaction effect of BLM and minority increase on RT expert rating ( $B = 20.71$ ,  $SE = 6.50$ ,  $t = 3.19$ ,

$P = 0.002$ ). A simple slope analysis of RT expert rating shows that minority increase is negatively associated with movie ratings before BLM ( $B = -16.74$ ,  $SE = 4.50$ ,  $t = -3.72$ ,  $P < 0.001$ ), but not after the advent of BLM ( $B = 3.97$ ,  $SE = 4.44$ ,  $t = 0.89$ ,  $P = 0.372$ ). Results are similar for RT audience rating and IMDb audience rating. This net positive moderation effect of BLM on the relationship between minority increase and movie ratings suggests that, overall, BLM exhibits a bias mitigation effect rather than a backlash effect.

**3.3.2.1. BLM benefits not only Black actors, but also other racial minority actors.** In our main analysis, minority increase encompasses all racial minority actors. To explore whether the same results hold for both Black and non-Black minority actors, we further categorize minority increase into Black increase and other minority increase, and interact each with BLM. Results suggest that before BLM, both a) Black increase and b) other minority increase are negatively and significantly associated with movie ratings; by contrast, after the advent of BLM, neither association is significant. This suggests that the bias mitigation effect of BLM applies to both Black and non-Black minority actors (*SI Appendix, section 2*).

**3.3.2.2. Ruling out other alternative explanations.** Next, we rule out two alternative explanations for why the audience dislikes movies with minority increase before BLM: a) the audience dislikes cast change per se and b) the audience dislikes actors with low credentials.

**3.3.2.2.1. Ruling out cast change aversion as an alternative explanation.** It is possible that the audience dislikes minority increase not because of racial bias, but rather because of their aversion to cast change per se. To rule out this possibility, we test and show that before BLM, movies with minority increase received significantly lower ratings than movies that underwent cast change without minority increase, i.e., when sequels replaced White actor(s) with other White actor(s). These results suggest that the negative effect of minority increase cannot be simply explained by a general aversion to cast change. Notably, BLM uniquely benefitted movies with minority increase, but not movies with cast change that did not increase minorities (*SI Appendix, section 4.1*).

**3.3.2.2.2. Ruling out actor credentials as an alternative explanation.** It is possible that the audience dislikes minority increase not because of taste-based bias, but simply because the minority actors have lower-performance credentials (i.e., statistical bias). To examine this possibility, we categorize minority actors into high- and low-credentialed groups relative to either a) all main cast actors or b) the White main cast actors that they replaced (*SI Appendix, section 4.2*). Results using either categorization show that before BLM, minority increase is negatively associated with movie ratings for both high- and low-credentialed minority actors. This suggests that the bias against minority actors cannot be explained by credential differences, indicating taste-based bias rather than statistical bias. After the advent of BLM, neither high- nor low-credentialed minority increase is negatively associated with movie ratings anymore, indicating BLM's effect on mitigating taste-based bias against racial minority actors.

**3.3.2.3. Measuring BLM continuously by its level of intensity.** BLM consists of a series of antiracism protests and events that have taken place since 2013 (33, 36). These interconnected events unfolded in adjacent or overlapping periods and collectively propelled the BLM movement over time. The lasting and multiwave nature of BLM points to possible variations in its level of intensity. We therefore conduct an intensity analysis (59, 62, 63) to measure BLM's impact continuously.

Utilizing data from Dunivin et al. (35), we develop four variables to measure BLM intensity. These year-level variables are a) the number of news articles that mention BLM slogans, BLM victim names, or the phrase "Black Lives Matter," b) the number of tweets that use the hashtag #BlackLivesMatter, c) the number

of tweets that mention “Black Lives Matter,” and d) the number of BLM-related protests that occur in the United States.

Each of these BLM intensity measures positively and significantly moderates the relationship between minority increase and movie ratings, indicating that the bias mitigation effect of BLM is more pronounced when the movement has a higher level of intensity (*SI Appendix, section 3*). For instance, as the number of tweets using the hashtag #BlackLivesMatter doubles, the RT expert rating of movies with minority increase is expected to increase by approximately 1.41 points on average; as the number of BLM-related protests doubles, the RT expert rating of movies with minority increase is expected to increase by approximately 3.2 points on average. We also generate a composite BLM intensity level variable by combining the four individual measures. This additional analysis again reveals a positive and significant interaction effect of minority increase and composite BLM intensity measure on RT expert ratings ( $B = 1.83$ ,  $SE = 0.60$ ,  $t = 3.06$ ,  $P = 0.003$ ). Results are similar for RT audience rating and IMDb rating (*SI Appendix, section 3*).

Together, the above sets of analyses offer converging evidence that BLM mitigates the negative association between minority increase and movie ratings, suggesting its role in reducing racial biases.

#### 4. Part 2: Text Analysis at the Movie Review Level

In Part 2, we examine movie viewers’ attitudes toward minority increase by analyzing the textual content of movie reviews. Compared to holistic and numeric movie ratings, review texts provide richer materials that reflect individuals’ underlying attitudes, thoughts, and feelings. Specifically, we examine whether movies with minority increase are more likely to receive toxic reviews. Review toxicity, as measured by the presence of hostile, offensive, abusive, and hateful language (64–66), serves as an indicator of disapproval or rejection of a movie. Following Part 1, we also examine whether the bias mitigation effect of BLM prevails in the context of movie reviews.

**4.1. Data.** Compared to reviews from movie critics with publicly disclosed identities, anonymized reviews are more reflective of the individuals’ uninhibited opinions and feelings, and therefore better suited for observing behaviors that violate social appropriateness, such as the use of hostile and offensive language (67). Thus, for the movies in Part 1, we collect all available 317,453 anonymous audience reviews from IMDb. Each review consists of a textual comment on the movie as well as a star rating from 1 to 10. To reduce the noise from repetitive reviews by the same users, we clean the data by removing duplicate reviews from the same user IDs for each movie. This process results in a final sample of 312,457 unique reviews of the 435 movies. These reviews are substantive, with an average of 245 words per review.

**4.2. Results: Movie Review Toxicity.** To measure movie review toxicity, we utilize Google Perspective, a machine-learning-based NLP model (68) widely used in prior studies with an accuracy rate of over 90% (69). For each movie review, we obtain a toxicity score between 0 and 1, with higher scores indicating a greater likelihood of toxicity. Minority increase positively predicts review toxicity ( $B = 0.004$ ,  $SE = 0.001$ ,  $t = 3.08$ ,  $P = 0.002$ ), suggesting that, on average, movies with minority increase are more likely to receive toxic reviews.

Next, we examine whether this relationship weakens after the advent of BLM. Consistent with Part 1, BLM negatively and significantly moderates the relationship between minority increase

and review toxicity ( $B = -0.006$ ,  $SE = 0.002$ ,  $t = -2.43$ ,  $P = 0.015$ ), indicating that movies with minority increase are less likely to receive toxic reviews after (vs. before) the advent of BLM. In addition, following Section 3.3.2.3, we further conduct intensity analysis by measuring BLM continuously. Using the composite measure of intensity, analysis reveals that BLM intensity significantly and negatively moderates the relationship between minority increase and review toxicity ( $B = -0.001$ ,  $SE = 0.0002$ ,  $t = -3.61$ ,  $P < 0.001$ ), indicating that movies with minority increase are less likely to receive toxic reviews when BLM intensity is high.

Together, these results indicate that BLM mitigates movie viewers’ negative evaluations of movies with minority increase.<sup>‡</sup> As robustness checks, we apply two additional NLP models with complementary abilities to a) detect implicit toxicity in the absence of curse words or slurs and b) directly capture racial minority identity attacks, respectively. Results are robust across these alternative NLP models (*SI Appendix, section 7*).

#### 5. Part 3: Preregistered Experiment

Parts 1 and 2 of the paper have documented the bias mitigation effect of BLM—whether operationalized as a binary variable (i.e., after vs. before BLM) or as a continuous measure of the movement’s intensity. To provide a direct causal test of BLM’s impact, we conduct a preregistered experiment, as detailed in *SI Appendix, section 8*. In addition to strengthening causality, the experiment also extends the archival analysis by providing a more targeted investigation of *White* movie viewers. Moreover, the experiment directly taps into movie viewers’ racial attitudes, measured as the extent to which participants perceive a Black actor introduced in the sequel movie as enhancing or detracting from the story. This allows us to examine whether participants’ racial attitudes explain (i.e., mediate) the impact of BLM on movie ratings.

Four hundred sixty-nine White American participants were randomly assigned to one of six conditions in a 3 (cast change)  $\times$  2 (BLM salience) between-subjects factorial design. The first factor, cast change, had three levels: a) cast change with minority increase, i.e., replacing a White actor with a Black actor, b) cast change without minority increase, i.e., replacing a White actor with another White actor, or c) no cast change. The second factor, BLM salience, had two levels: a) reading an article about BLM (i.e., BLM salient) or b) reading an article about solar technology (i.e., BLM not salient).

Analysis shows a significant interaction between cast change and BLM salience ( $F(1, 445) = 4.37$ ,  $P = 0.037$ ), such that increasing the salience of BLM (i.e., by assigning participants to read a BLM-related news article) leads the participants to give higher ratings to a sequel movie with minority increase, compared to a sequel movie without cast change or a sequel movie that undergoes cast change without minority increase. Consistent with our prediction, BLM salience also leads participants to exhibit more favorable attitudes toward the minority actor introduced in the sequel,  $t = 3.06$ ,  $P = 0.003$ , 95% CI = [0.25, 1.16]. Finally, a mediated moderation model reveals a significant indirect effect of BLM salience on movie ratings via attitudes toward the minority actor,  $B = 0.67$ , 95% CI = [0.30, 1.04]. That is, when BLM is salient (vs. not), participants evaluated the newly added minority actor more favorably, thereby boosting the overall evaluation of the sequel movie. In sum, this experiment conceptually replicates the bias mitigation effect of BLM.

<sup>‡</sup>For completeness, we also conduct analyses of movie ratings at the individual review level. Consistent with Part 1, a negative relationship is observed between minority increase and movie ratings ( $B = -0.24$ ,  $SE = 0.03$ ,  $t = -9.58$ ,  $P < 0.001$ ). Moreover, this relationship is positively and significantly moderated by BLM, measured as either a binary ( $B = 0.15$ ,  $SE = 0.05$ ,  $t = 3.24$ ,  $P = 0.001$ ) or a continuous variable ( $B = 0.01$ ,  $SE = 0.004$ ,  $t = 2.71$ ,  $P = 0.007$ ).

## 6. General Discussion

Analyzing a unique panel dataset of movie series and a large corpus of movie reviews, the present research investigates how movie viewers react to the increase of racial minority actors in the main cast. We find that movies with minority increase tend to receive lower ratings and more toxic reviews, but these effects are mitigated after the advent of BLM. We also quantify the intensity of the movement's impact by tracking the level of BLM's public engagement. A preregistered experiment conceptually replicates the archival study and causally demonstrates the bias mitigation effect of BLM.

**6.1. Theoretical Contributions.** The current research offers important theoretical contributions. First, we contribute to the literature on DEI by adjudicating the competing theoretical possibilities regarding audience reactions to increased minority presence in movies. While discrimination research predicts that the audience may reject minority increase, both the value-in-diversity perspective and the fairness perspective predict that the audience may welcome minority increase. Consistent with the discrimination perspective, we find that minority increase negatively predicts movie evaluations. We also find evidence that the nature of this discrimination is taste-based by a) ruling out credential-based justifications for differential ratings and b) identifying toxic language in movie reviews. Critically, we find that such a bias is not static, but rather contingent on the changing social context of race. We therefore further contribute to DEI research by pivoting the field's focus toward the evolving sociocultural environment.

Second, we advance the literature on social movements, especially the impact of BLM. As the sociocultural space shifts toward racial progressivism in the wake of BLM (35, 45), concerns about performative racial inclusivity have emerged in the popular press (47) and academia (48). These concerns are often accompanied by skepticism and cynicism that racial minority increase serves merely as a façade of equality, masking systemic problems of discrimination. These perceptions may taint people's opinions, potentially resulting in viewers downrating movies with minority increase. By demonstrating a net positive effect of BLM on audience reactions to minority increase, we provide evidence against the argument that due to its potential backlash effect, BLM may be overall ineffective in fostering racial equality and inclusion. This advances theoretical understandings of the social impacts of BLM and antiracism movements more broadly.

Third, our research contributes to the literature on bias reduction and social change. The majority of bias reduction studies have focused on experiment-based, micro-level interventions; rarely considered are macrosocial influences (for a review, see ref. 70). Our study fills this gap by suggesting that BLM, a social movement facilitated by digital activism, is capable of bringing about changes and mitigating racial biases. Notably, we reveal changes not only at the aggregated movie rating level but also at the individual movie review level, unveiling the microfoundations underpinning the bias mitigation effect of BLM. Moreover, we quantify BLM's impact by examining its intensity in both offline and online settings. In doing so, we heed the call from social movement scholars to examine the power of new media-enabled social movements in instigating social change (37).

**6.2. Practical Implications.** The current research also offers meaningful practical implications. To start, we document the presence of racial bias against minorities in movie consumption, a highly popular cultural activity. However, we also show that such racial bias may be responsive to changes in the macrosocial environment. This suggests that stakeholders in the entertainment

industry, such as filmmakers and marketers, should monitor the changing cultural landscape in society, especially when appraising the effectiveness of diversity-related practices or product changes.

Second, our research suggests that continued efforts are required to redress racial bias at the societal level. For example, movie review websites should be vigilant in identifying and addressing racially toxic comments. While our research focuses on racial minority presence in movies, our findings may be applicable to other cultural products (e.g., TV shows, video games) and domains beyond entertainment. For example, as social media platforms (e.g., Instagram, TikTok) soar in popularity, companies have the opportunity to promote diversity and inclusion through their communication and advertising content.

Finally, our paper underscores the role of social movements in driving social change. New media engagement is integral to BLM, affording the movement sustained public attention and wide participation (36). The findings of our study imply that the public's attitudes toward minority groups are sensitive to digital campaigns. Collective actions in the current era could harness new media technologies and platforms to amplify their claims. This is particularly relevant for movements with a strong online presence that advocate for the rights of marginalized groups, such as women (e.g., #MeToo, #WomensMarch, #HeForShe), indigenous peoples (#IdleNoMore), and sexual minorities (e.g., #PrideMarch).

**6.3. Limitations and Future Directions.** The present research has several limitations. First, while we recognize that both movie viewers and actors can belong to different racial groups, our paper focuses on White viewers' reactions to non-White actors (for the reasons discussed in Sections 1.4 and 2). Although the racial identities of movie viewers who provide ratings and reviews are not always discernible, we address this limitation by conducting a) a subsample analysis on White viewers (*SI Appendix, section 5*) and b) a preregistered experiment that specifically recruited White participants (*SI Appendix, section 8*). Future research could further consider the dynamics between movie viewers and actors from different racial groups. This direction can be fruitful in light of theoretical discussions on how different racial groups, such as Asians and Hispanics, are perceived by White people as possessing different stereotypical characteristics (71–73).<sup>§</sup>

Second, in examining the sociocultural context of race, we focus on BLM because existing literature identifies it as one of the most thematically representative and largest movements propelling changes in racial relations. However, we acknowledge that other changes in society may also shape racial dynamics. To address this, we examine several aspects of the macrosocial environment, such as the economic and political climate, and show that the effect of BLM is reliable after accounting for these influences (*SI Appendix, section 6*). Nevertheless, our examination of these social influences cannot be exhaustive, and future research could investigate how other social changes may affect racial relations.

Last, the two-decade span of our observation period enables us to observe changes in racial attitudes among the movie audience before and after the advent of BLM. These changes likely represent a shift from traditional racialism that justifies inequality to a structuralist perspective that advocates for equality (34). As more movie series are introduced or expanded, future research could extend the current research by exploring the changing dynamics of race in the film industry and beyond.

<sup>§</sup>Due to data sparsity of non-Black minority groups (e.g., Asian, Hispanic), we refrain from further separating them to conduct formal analysis or draw conclusions regarding their homo/heterogeneity.



## 7. Methods

$$y_{ij} = \beta_0 + \beta_1 \times \text{minority increase}_{ij} + \beta_2 \times X_{ij} + \gamma_t + \delta_i + \epsilon_{ij} \quad [1]$$

$$y_{ij} = \beta_0 + \beta_1 \times \text{minority increase}_{ij} + \beta_2 \times \text{minority increase}_{ij} \times \text{BLM}_i + \beta_3 \times X_{ij} + \gamma_t + \delta_i + \epsilon_{ij} \quad [2]$$

where  $y_{ij}$  is the outcome variable (i.e., RT expert rating, RT audience rating, or IMDb audience rating).  $i$  denotes movie series  $i$ ;  $j$  denotes the  $j$ -th movie in series

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