Marketing Letters (2023) 34:293–308
https://doi.org/10.1007/s11002-022-09652-5

Hollywood caught in two worlds? The impact of the Bechdel test on the international box office performance of cinematic films

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Accepted: 10 October 2022 / Published online: 18 October 2022

Abstract
The Bechdel test is increasingly used in academia as a quality indicator for the portrayal of women in films. Previous studies explored how passing the Bechdel test affects box office earnings. However, earlier considerations were all limited to the US market. Therefore, the impact of the Bechdel test on international box office receipts is still unclear. To fill this research gap, this study examines the box office effect for internationally released films at the country level. Using a sample of 515 randomly selected Hollywood films, it is shown that passing the test significantly improves international box office earnings. However, the results also show that the effect depends on the level of socioeconomic development in the respective countries. Cultural discount theory is used to explain the empirical findings.

Keywords Hollywood · Film industry · Box office performance · Bechdel test · Cultural discount

JEL Classification C21 · F63 · J16 · L82

1 Introduction

Hollywood has been criticized for years for stereotyping and marginalizing women in films (Donald, 2015; Kagan et al., 2020). As many studies have shown, female actors receive less screen time and dialogue than their male counterparts, are less likely to play the lead, and are often subjected to inappropriate gender stereotypes on screen (Lauzen, 2008). Although gender inequality in representation is evident, surprisingly little has changed in Hollywood over the years (Hunt & Ramon, 2020; Karniouchina et al., 2022). When faced with criticism, the Hollywood film industry

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often cites its dependence on international markets (De La Cruz et al., 2019). This is because more than half of theatrical film sales are made in the rest of the world and not in the US market (Walls & McKenzie, 2012). Film studios must therefore produce the movie content that is in demand internationally (Pedace, 2017). This leads to the conclusion that a more balanced gender representation in film is not well received internationally and that Hollywood continues to rely heavily on male stereotypes for fear of losing international revenue (Lindner et al., 2015). Despite the sociopolitical explosiveness of this statement, however, this relationship has not yet been empirically investigated. In fact, there are a few isolated studies, but they are all limited to the US market (Hickey, 2014; Sharma & Sender, 2014; Valentowitsch, 2022). Studies that examine international sales of theatrical films from the perspective of gender representation are lacking. Consequently, the impact of a more balanced gender representation on international box office results has not yet been adequately studied. This paper will therefore clarify whether a more balanced gender representation indeed has a negative impact on international box office results, as Hollywood often claims. The basis for the empirical investigation is provided by the cultural discount hypothesis, which suggests that media products traveling across cultures are perceived and demanded in a locally specific way (Lee, 2006). Consistent with the cultural discount hypothesis, international markets with a similar level of socioeconomic development as the US home market are found to demand films with balanced gender representation more than those with a divergent level of development.

2 Gender portrayal in film and the Bechdel test

The quality of cinematic gender representation is determined in this study using the Bechdel test. The idea for the test was developed by Alison Bechdel in her comic "Dykes to Watch Out For" (Bechdel, 1986). To pass the test, three criteria must be met: first, there must be at least two female roles in the film. Second, the women must talk to each other, and third, the content of their conversation must be about something other than a man (Yang et al., 2020). In developing the test criteria, Alison Bechdel said that she was inspired by Virgina Woolf, who stated in an essay that she knew of no female characters described as friends in novels. There were isolated cases of mother-daughter relationships, she said, but almost without exception the female characters were portrayed in their relationship with a man (Woolf, 1929).

Although the original intent was not to design a scientific test procedure, the Bechdel test has gained acceptance in academia in recent years as a useful indicator for identifying biased gender representations. Garcia et al. (2014), for example, applied the Bechdel test to 704 movie trailers on YouTube. The results of their study indicated that male-oriented movie trailers were more popular. Lindner et al. (2015) investigated how the portrayal of women affects box office revenue. According to their results, movies that pass the Bechdel test achieve lower box office earnings. Sap et al. (2017) applied the Bechdel test to 7772 film scripts and found that films in which female characters speak with high authority are less likely to pass the test. In a more recent study, Valentowitsch (2022) examined the impact of passing the

Bechdel test on the success of cinematic films at the box office. On average, his results show that films that pass the test achieve significantly higher box office takings. However, his results also suggest that for films with high production costs, gender balance is not a primary determinant of box office earnings. However, the study conducted by Valentowitsch has one significant limitation. Like earlier research, his data analysis is limited to the US market.

In the scientific literature, however, the Bechdel test was not only met with approval. Some authors questioned the suitability of the test as an indicator of gender representation, arguing that the Bechdel test sets too simple criteria for passing (van Raalte, 2015). The criticism reflects the fact that even a few lines of dialogue between two female actors are enough to pass the test. Thus, even films that are very one-sided in their gender portrayal can easily pass the test (Donald, 2015). Although the criticism is justified in essence, the argument can be weakened upon closer examination. Even though the Bechdel test is sensitive to small lines of dialogue between female actors, nearly 60% of all film productions still fail the test (Kagan et al., 2020). Applying more rigorous criteria would therefore further limit the empirical sample of films that pass the test making empirical analysis more challenging by lowering data variance (Lindner et al., 2015).

The great scientific interest in the Bechdel test can also be explained by its strong influence on media discourse and the film industry itself. In recent years, the popular media has frequently called attention to malpractices in Hollywood, pointing out that many blockbuster films fail the test (Sharma & Sender, 2014). Since that kind of negative media coverage has a strong influence on potential cinema audiences, Hollywood cannot simply ignore this problem (Hickey, 2014). Moreover, the Bechdel test is also increasingly becoming a hygiene factor in the film industry. For example, the awarding of film prizes or the broadcasting of films in cinemas around the world is increasingly linked to passing the test (Martinez, 2016). So from Hollywood's point of view, whether a film passes the Bechdel test is no longer a minor issue, but an important aspect to consider when designing new films (Valentowitsch, 2022).

3 Theoretical background: the cultural discount hypothesis

The theoretical basis for the study is provided by the literature on cultural discount. The idea goes back to early attempts in media economics to establish a microeconomic theory of imbalances in cross-market media flows (Hoskins & Mirus, 1988; Waterman, 1988; Wildman & Siwek, 1988). The fundamental consideration is that an audience will not evaluate a media product from a foreign market in the same way as the audience in the home market due to cultural and social differences. Thus, the value of the foreign media product is discounted (Lee, 2009). The level of discount depends on many different aspects. Empirical studies have identified media content (Lee, 2006, 2008), language barriers (Fu & Sim, 2010; Volz et al., 2010), geographic and cultural proximity of the home and foreign markets (Meloni et al., 2018), and differences in institutional and social conditions (Özmen, 2018) as crucial determinants of cultural discount. Complementing this research, the present study focuses on a set of socioeconomic development indicators that can be

associated with women's role in society. Consistent with the cultural discount theory, it is hypothesized that films with a more balanced gender representation will experience greater discounts in international markets the more the socioeconomic development levels of the corresponding countries differ from those of the US home market. Thus, it is assumed that societies that still have a traditional understanding of gender roles are less familiar with progressive gender representations in film than those that are more open to balanced gender representations due to their cultural proximity to Western world. There are a number of psychological and sociological arguments in favor of such a view. For one thing, many studies have shown that people with similar cultural backgrounds identify more easily with each other and develop a sense of common belonging more readily (Abrams & Hogg, 2004; Froehlich et al., 2021; Schwartz et al., 2008). People with similar socioeconomic and cultural backgrounds are also more likely to share common interests, worldviews, and values, and more likely to agree on their attitudes about the social status of men and women (Tajfel & Turner, 1986). Second, marketing-related research on the homophily concept has shown that people who are similar in cultural and socioeconomic aspects also make similar purchasing and consumption decisions (Bu et al., 2022; Ma et al., 2014; Mark, 2003). This logic also applies to demand for films and other media products. For example, cross-national comparative studies have shown that consumer preferences for Hollywood films critically depend on how culturally close countries are (Lee, 2008; Meloni et al., 2018).

4 Hypotheses

This study examines the impact of passing the Bechdel test on the international box office performance of Hollywood films. As discussed in the previous chapters, the relevant research question has not yet been examined in an international context. While there are some studies that have explored the effect at the box office in the US market, the impact at the international box office has not been scientifically studied. To address this research gap, the following section presents research hypotheses on main and moderating effects related to international box office performance based on the concept of cultural discount.

4.1 Main effects

Although it is not clear a priori how passing the Bechdel test affects box office results, this study assumes a negative relationship. In many countries, the strong presence of women in the media is still unusual due to social, cultural, and historical development paths (Martinez, 2016; van Raalte, 2015). Especially in cinematic representation, women are often reduced to clichéd roles such as housewives or lovers and marginalized by playing minor characters that are not relevant to the plot (Lindner et al., 2015; Yang et al., 2020). Thus, it can be hypothesized that films that pass the Bechdel test are perceived negatively by international film consumers who are attached to more traditional and conservative conceptions of gender. This is because

a progressive portrayal of women potentially increases the cultural discount for a film, which must translate into poorer box office results. This leads to the following hypothesis:

H1: Hollywood films that pass the Bechdel test have poorer international box office receipts.

Based on the logic of the cultural discount, it can also be assumed that success at the international box office depends on how much the home and target markets differ (Meloni et al., 2018). Thus, target markets that are similar to the US home market in socioeconomic terms will require a smaller cultural discount on home market media goods than those that are very different (Lee, 2009). Since the US home market has a high level of socioeconomic development, countries with a similar level of development must be culturally closer to it and therefore demand a lower cultural discount (Özmen, 2018). This rationale leads to the next hypothesis for this study:

H2: The higher the socioeconomic development level of a target country, the higher the box office receipts of Hollywood films.

4.2 Moderation effects

The social status of women varies around the world (Htun & Weldon, 2018). While women in Western societies are legally equal to men and have experienced a strong social upswing in recent decades thanks to feminist movements, both legal equality and social acceptance of women remain problematic in many other parts of the world (Becchio, 2020). Given the unequal social position of women in the world, it can be assumed that the higher the socioeconomic development level of the respective country, the smaller the cultural discount that audiences will demand for progressive portrayals of women in film. Thus, the negative box office effect hypothesized to be related to passing the Bechdel test will interact positively with the level of socioeconomic development of the countries. This leads to the following hypothesis:

H3: The higher the socioeconomic development level of the target country, the lower the negative box-office effect caused by passing the Bechdel test.

5 Data and methodology

In further analysis, a distinction is made between domestic and foreign markets. Please note that the USA is considered the domestic market. All films in the data set were produced by US studios and were also first released in the USA. Consequently, all international markets in which the films were subsequently distributed are considered to be foreign markets. To examine how passing the Bechdel test affects international box office performance, this study examines the box office earnings

of 515 randomly selected Hollywood films distributed from 2010 to 2018 in a total of 29 countries. Data for the analysis was compiled from various internet databases. Cinema statistics and financial performance figures were obtained from the website the-numbers.com. Genre classifications of films and other film-specific metrics were taken from the IMDd database. How well a film performed on the Bechdel test was evaluated on the website bechdeltest.com. After merging the data and adjusting for missing values, a total of 9337 observations remained for further investigation. A detailed listing and description of all variables is included in Table 1.

Despite a random selection of films from the IMDd database, the final sample may still be subject to selection bias. In particular, there is a possible bias in favor of high-budget films. Some authors have suggested that passing the Bechdel test may be related to a film's budget (Valentowitsch, 2022). As Lindner et al. (2015) have noted, films produced by women and dealing with women's issues tend to have lower budgets. Furthermore, low-budget films are less likely to be released internationally, so such films may be systematically underrepresented in the sample. To ensure that there is no systematic bias, the distribution of films was subjected to descriptive screening. In fact, the empirical distribution shows a tendency toward high budgets. The average production cost of the films in the dataset is about 83 million dollars. However, a quarter of the films have a production budget of less than 30 million dollars. The dataset also includes films with very low budgets, ranging from 100 to 200 thousand dollars. So despite some skewness in the distribution, there is no structural effect of concern.

Two composite indicators are used to measure socioeconomic differences in international markets in terms of cultural discount theory. The one is the Human

Table 1 Dataset variables

Variable	Measurement
Box office earnings	Country-specific box office results in US dollars (log-transformed)
Market size	Market size approximated by the population size of a country (log-transformed)
Production budget	Production budget in US dollars (log-transformed)
Max. playing theaters	Maximum number of theaters that screened a film in the home market (log-transformed)
Average playing time	Average playing time of a film in theaters in the home market in weeks (log-transformed)
Release lag	Time lag in months between domestic and foreign market release
Franchise dummy	Binary variable: 1 if a film is part of a franchise, 0 otherwise
Bechdel test	Binary variable: 1 if a film passes the Bechdel test, 0 otherwise
Films per director	Instrumental variable: Indicates the total number of films by a director that passed the Bechdel Test
Women, Peace & Security Index	An index that measures the autonomy and self-determination of women at home, in the community and in society. The value range is between 0 and 1
Human freedom index	An index that encompasses personal, civil, and economic freedom. The value range is between 0 and 10

Freedom Index, published jointly by the Cato Institute, the Fraser Institute, and the Liberal Institute of the Friedrich Naumann Foundation for Freedom. The second one is the Women, Peace & Security Index as a measure of women's well-being and empowerment, published by the Institute for Women, Peace and Security (GIWPS) at Georgetown University and the Peace Research Institute of Oslo (PRIO). Both index variables rely on social and economic factors in their calculation and are therefore suitable as approximations for the level of socioeconomic development.

The study further uses a number of film-specific control variables that have been shown to be good predictors of box office outcomes in previous studies (Basuroy & Chatterjee, 2008; Treme et al., 2019). Specifically, these are as follows: The size of the sales market approximated by the population of a country, the production budget, the maximum number of theaters played a film, and the average playing time in theaters measured in weeks. The last two indicators refer to the US cinema market. A number of studies have shown that both variables are good predictors not only of domestic but also of international box office success (Ryu, 2020, Liu, 2006, Elberse and Elishaberg 2003). Both variables are therefore included as controls in the estimates.

In addition, a dummy variable was constructed to measure whether a film was a sequel or a franchise production, as these films have been shown to generally have a higher audience in theaters (Basuroy & Chatterjee, 2008). Furthermore, the time lag between the theatrical release in the US home market and the international target market was considered a control variable. Several studies have shown that the length of the time lag has a negative impact on box office results (Ahmed & Sinha, 2016; Elberse & Eliashberg, 2003).

The descriptive statistics and correlations of the variables included in the data set are summarized in Table 2. The target variable, box office earnings, shows significant correlations with all explanatory variables except the human freedom index. There are also remarkably high correlations between the two index variables (10) and (11). In order to avoid multicollinearity problems, each index variable was included separately in the regression models. The variance inflation factors, also reported in Table 2, show that this approach successfully reduced the threat of multicollinearity. As widely recommended in the literature, all VIF values are well below the critical threshold of 5 (Larose & Larose, 2015).

A two-stage estimation approach was adopted to assess the impact of the Bechdel test on international box office earnings. This is a standard procedure when endogeneity is suspected for one or more regressors (Ebbes et al., 2022). In the specific context of this study, especially the Bechdel test variable is likely to violate the exogeneity assumption. Because whether a film passes the test is not a matter of coincidence, but a result of strategic decision-making by the screenwriters, directors, and film studios that produce the film. Therefore, in this study, a probit model is first calculated by implementing the Bechdel test as the dependent variable. The instrument used is the number of films produced by the director that have previously passed the Bechdel test. The results of the first stage probit regression are documented in Table 4. To test whether the instrument is weak, the F-statistic was considered. The calculated F-value indicates that the instrumental variable is well suited for analysis. In the second stage, the fitted values

Table 2 Descriptive statistics, variance inflation factors, and correlations

	Min	Max	Mean	SD	VIF	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
(1) Box office earnings	−3.00	13.75	7.48	2.06	-	1.00										
(2) Market size	14.86	21.05	17.62	1.41	1.52	0.50***	1.00									
(3) Production budget	11.51	19.72	17.85	0.99	1.71	0.40***	0.02†	1.00								
(4) Max. playing theaters	3.93	8.42	8.05	0.42	1.59	0.31***	0.00	0.57***	1.00							
(5) Average playing time	0.00	2.29	1.59	0.36	1.20	0.33***	0.00	0.35***	0.33***	1.00						
(6) Release lag	0.00	119.0	1.02	2.51	1.07	−0.16***	0.01	−0.17***	−0.22***	−0.01	1.00					
(7) Franchise dummy	0.00	1.00	0.35	0.48	1.23	0.27***	0.01	0.41***	0.31***	0.23***	−0.15***	1.00				
(8) Bechdel test	0.00	1.00	0.57	0.50	1.08	0.06***	−0.01	−0.03**	0.13***	0.18***	−0.05***	0.10***	1.00			
(9) Films per director	0.00	1.00	2.58	2.22	1.04	0.11***	0.01	0.17***	0.13***	0.14***	−0.04***	0.04***	0.27***	1.00		
(10) Women, Peace & Security Index	0.58	0.86	0.76	0.07	1.12	0.14***	−0.33***	−0.05***	−0.05***	−0.02*	0.02	−0.03**	0.01	−0.01	1.00	
(11) Human freedom index	6.01	8.88	8.14	0.86	1.46	0.02	−0.56***	−0.03**	−0.03***	−0.01	−0.01	−0.02*	0.01	−0.01	0.72***	1.00

The VIF values of the index variables refer to estimates in which variables (10), (11), and (12) were included in the models individually. Significance codes: ***$p < 0.001$, **$p < 0.01$, *$p < 0.05$

of the first stage probit estimate are regressed on box office earnings instead of the endogenous regressor, along with all other control variables. The Durbin-Wu-Hausman test suggests that this step is necessary because the original Bechdel test variable is endogenous. The results of the *F*-test also suggest that the fitted values from the probit estimation work well as an instrument.

6 Results

The analysis begins with a replication of the results observed by Valentowitsch (2022). For this purpose, a model similar to that used by Valentowitsch is formulated. The control variables and the Bechdel test variable are added sequentially (Table 3). The model is estimated using US data. As described earlier, to avoid endogeneity problems with the Bechdel test, the instrumental variable approach is used. The estimation results show that the findings documented by Valentowitsch (2022) can be replicated. Thus, films that pass the Bechdel test have, on average, higher box office returns in the US market when all other factors are held constant.

Table 3 Replication of results reported by Valentowitsch, (2022)

Regression models	Probit	OLS (1)	2SLS	OLS (2)
Intercept	0.667	−2.487***	−2.502***	−2.493***
	(0.952)	(0.352)	(0.359)	(0.349)
Films per director (instrument)	0.125***	-	-	-
	(0.020)	-	-	-
Ln (production budget)	0.062	0.184***	0.183***	0.184***
	(0.055)	(0.024)	(0.024)	(0.023)
Franchise dummy	0.213*	0.322***	0.304***	0.315***
	(0.105)	(0.038)	(0.040)	(0.038)
Ln (max. playing theaters)	-	0.915***	0.898***	0.909***
	-	(0.040)	(0.042)	(0.040)
Ln (average playing time)	-	1.795***	1.716***	1.765***
	-	(0.047)	(0.061)	(0.048)
Bechdel test	-	-	0.135*	0.051**
	-	-	(0.063)	(0.016)
Genre dummies	Yes	Yes	Yes	Yes
N	520	520	520	520
R-squared	0.14	0.91	0.92	0.92
F-test	6.858***	428.6***	383.6***	406.3***
Durbin Wu Hausman Test	-	-	1.986	-
Weak Instrument Test	-	-	34.139***	-

In all models, the dependent variable is domestic box office performance in thousands of US dollars (log-transformed); country-specific variables were dropped for the US data estimates. Significance codes: ***$p < 0.001$, **$p < 0.01$, *$p < 0.05$

To test whether this finding also holds for the international cinema market, the estimation procedure is repeated with the inclusion of country-specific control variables (Table 4). The stepwise addition of the controls, the Bechdel test, and the index variables successively increases the *R*-squared of the estimates, indicating that each model extension increases the proportion of explained data variance. Similarly, the Akaike information criterion successively decreases, indicating that each model fits the data more closely. The estimates of the controls are highly significant and consistent with expectations derived from the literature. The estimate of the Bechdel test variable is again statistically significant and has a positive sign. Thus, films that pass the Bechdel test tend to have higher box office takings on average, even when compared internationally. This empirical result is inconsistent with our original theoretical hypothesis. However, once the interaction is taken into account, the estimate of the Bechdel test changes its direction and becomes negative. But the interaction term remains positive. The influence of the Bechdel test on box office earnings thus depends on the level of socioeconomic development. The estimated relationship is detailed in Fig. 1. As shown in this illustration, the effect of the Bechdel test on box office earnings depends on the levels of the two index variables. The overall effect becomes positive for WPS at a value of 0.68, which corresponds to a rank of 106 on a total of 167 countries. Similarly, the sign flips from negative to positive for HFI at a value of 6.46, which is equivalent to a rank of 116 on a total of 165 countries. Thus, a low socioeconomic standing implies a negative influence of the Bechdel test variable on box office returns. Conversely, the higher the socioeconomic standing of a country, the stronger the positive influence of the interaction term on box office takings. This finding is consistent with initial expectations and also supports the theoretical hypotheses made in advance.

7 Discussion

Overall, the results of the study show that films that pass the Bechdel test achieve higher box office takings internationally. The empirical findings thus support and extend earlier research that found a positive link between the Bechdel test and box office takings in the US market (Valentowitsch, 2022). At the same time, the results also show that the impact of passing the Bechdel test on international box office performance depends on the level of socioeconomic development, which is consistent with the expectations from the cultural discount theory. This study thus fills an important research gap, as recent literature has already hypothesized that a country's level of socioeconomic development has a decisive influence on the demand for media goods (Özmen, 2018). However, how exactly socioeconomic factors influence demand has not been sufficiently explored. The present study therefore makes an important contribution in this direction. It is also noteworthy that the positive effect of the Bechdel test on international box office performance is found to be statistically robust even after controlling for endogeneity. This is important because a recent study by Karniouchina et al. (2022) showed that gender differences in film performance disappear once controlling for endogeneity. However, their study did not focus on the cinematic representation of women, but on the production side of

Table 4 Probit, OLS, and 2SLS regressions

Regression models	Probit	OLS	2SLS (1)	2SLS (2)	2SLS (3)	2SLS (4)	2SLS (5)
Intercept	2.409***	−33.957***	−34.238***	−37.874***	−34.197***	−44.710***	−42.278***
	(0.240)	(0.648)	(0.652)	(0.616)	(0.969)	(0.614)	(0.875)
Films per director (instrument)	0.111***	-	-	-	-	-	-
	(0.005)	-	-	-	-	-	-
Ln (production budget)	-0.025	0.539***	0.533***	0.532***	0.532***	0.536***	0.535***
	(0.014)	(0.020)	(0.020)	(0.019)	(0.019)	(0.018)	(0.018)
Franchise dummy	0.299***	0.378***	0.323***	0.326***	0.327***	0.330***	0.330***
	(0.024)	(0.030)	(0.034)	(0.032)	(0.032)	(0.030)	(0.030)
Ln (max. playing theaters)	-	0.270***	0.265***	0.284***	0.283***	0.301***	0.300***
	-	(0.039)	(0.039)	(0.037)	(0.037)	(0.035)	(0.035)
Ln (average playing time)	-	1.277***	1.270***	1.271***	1.268***	1.263***	1.262***
	-	(0.040)	(0.040)	(0.037)	(0.037)	(0.035)	(0.035)
Ln (market size)	-	1.568***	1.569***	1.335***	1.337***	1.470***	1.470***
	-	(0.030)	(0.030)	(0.029)	(0.028)	(0.026)	(0.026)
Release lag	-	−0.076***	−0.075***	−0.077***	−0.077***	−0.069***	−0.068***
	-	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Bechdel test	-	-	0.185***	0.184***	−1.493***	0.188***	−0.917**
	-	-	(0.052)	(0.049)	(0.345)	(0.046)	(0.287)
Women, Peace & Security Index (WPS)	-	-	-	10.046***	5.239***	-	-
	-	-	-	(0.270)	(1.015)	-	-
Human freedom index (HFI)	-	-	-	-	-	1.502***	1.192***
	-	-	-	-	-	(0.030)	(0.085)
Bechdel test × WPS	-	-	-	-	2.194***	-	-
	-	-	-	-	(0.447)	-	-

Table 4 (continued)

Regression models	Probit	OLS	2SLS (1)	2SLS (2)	2SLS (3)	2SLS (4)	2SLS (5)
Bechdel test × HFI	-	-	-	-	-	-	0.142***
	-	-	-	-	-	-	(0.036)
Country dummies/genre dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	9337	9337	9337	9337	9337	9337	9337
R-squared	0.12	0.66	0.67	0.71	0.71	0.74	0.74
Akaike information criterion	-	29,902	29,892	28,595	28,573	27,638	27,625
F-test	38.51***	498.2***	486.0***	579.7***	567.3***	668.0***	652.7***
Durbin Wu Hausman Test	-	-	12.2***	14.35***	14.99***	16.85***	12.92***
Weak Instrument Test	-	-	534.4***	534.3***	267.2***	534.4***	267.3***

In all models, the dependent variable is international box office performance in thousands of US dollars (log-transformed). Significance codes: ***$p<0.001$, **$p<0.01$, *$p<0.05$

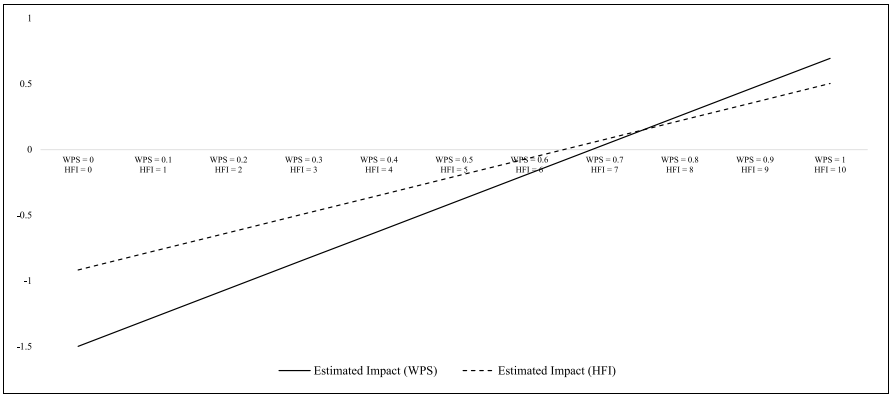

Fig. 1 Estimated total effect of Bechdel test on Ln (Box Office Earnings) by Index Level

the films. Specifically, Karniouchina et al. examined the composition of the production team and the filmmaker's gender. Indeed, their findings show that male and female directors produce films with similar box office takings once selection effects are taken into account. However, their results also indicate that male directors are systematically favored with regard to project allocation, budgeting, and distribution.

Another important finding of this study is the identification of statistically significant interactions. The reported interaction with the level of socioeconomic development suggests that the perception of women on screen is not homogeneous around the world. This is because films that pass the Bechdel test achieve significantly higher box office results in international markets with higher levels of socioeconomic development. Thus, the empirical findings of this study may provide an important explanation for why Hollywood continues to produce films with unbalanced gender representation despite growing social pressures in its home market. After all, Hollywood film studios look to the preferences of international audiences to maximize box office returns (Pedace, 2017). And because balanced gender representation is not equally accepted around the world, Hollywood film production adapts accordingly. These findings also complement the widely held view, especially in sociological research, that gender inequality in film is primarily due to Hollywood's male-dominated structures (Lindner et al., 2015). While the structural thesis describes a push factor in sociology, this study identifies a complementary pull factor that helps to understand how film supply is also determined by international demand. Thus, it is not only the masculinized structures in the film industry that are responsible for gender bias, but also the preferences of international audiences.

8 Conclusion

The empirical analysis of the international box office takings of 515 Hollywood films in this study shows that passing the Bechdel test is associated with significantly higher box office earnings. Furthermore, the results of the regression analysis

indicate a positive interaction of the Bechdel test variable with the socioeconomic development level of international markets. The higher the level of socioeconomic development, the higher the positive effect at the box office. However, the results also show that for very low levels of socioeconomic development, the isolated effect of the Bechdel test variable is negative. To theoretically contextualize the empirical findings, the cultural discount hypothesis is used as an explanation. Consistent with theoretical expectations, it appears that countries closer to the US home market in socioeconomic terms demand a smaller discount for balanced gender representation in film. Even though film audience preferences have converged around the world due to the long dominance of Hollywood studios, there are still international differences in what cinematic representation of men and women is desired. This presents filmmakers with a dilemma. While societal pressures in Western countries continue to increase and demands for more balanced gender representation grow louder, film studios are unable to comply due to their dependence on international sales. The findings of this study show that the behavior of film studios on this issue may indeed be economically motivated. However, the study also has some limitations. For example, some influencing factors that have been shown to be relevant in other studies were not considered. In particular, these include aspects such as word of mouth and advertising (Kwak & Zhang, 2011; Liu, 2006; Zufryden, 1996), star power (Treme et al., 2019), award wins (Lee, 2009), and the timing of film release (Chiou, 2008). Thus, findings documented in this paper require further investigation in subsequent studies. Moreover, even though the study provides evidence that gender bias in cinematic representation may be due to economic motivations, there is still room for alternative explanations. Thus, the marginalization of women on screen could also be due to old-fashioned role models that still exist among both viewers and filmmakers. The recent developments and setbacks of the women's movement in the USA, for example, show that gender equality is still a hot topic even in Western societies.

Funding Open Access funding enabled and organized by Projekt DEAL.

Declarations

Conflict of interest The authors declare no competing interests.

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