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Full Length Article

Accepting or fighting unlicensed usage: Can firms reduce unlicensed usage by optimizing their timing and pricing strategies?



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ABSTRACT

The rise of the Internet and new online services have led to the wide-scale illegal distribution of digital entertainment products, such as music, movies, games, and books. We analyze whether firms in the entertainment industry should fight unlicensed usage by providing specific offers that maximize the utility for segments relying on unlicensed usage, i.e., by optimizing timing and pricing strategies, or whether they should simply accept a certain level of unlicensed usage. We combine Becker's (1968) economic approach to analyzing social issues with random utility theory to develop a choice model for media products in which we account for unlicensed usage. We then apply the model in two large-scale empirical studies on movies and books. The results show that consumers who prefer unlicensed usage are sensitive to the marketing mix to some extent in both markets. However, optimizing timing and pricing only has limited impact on additional revenue generation. Thus, from a managerial perspective, it is very difficult to reduce the relative loss due to unlicensed usage by providing targeted offers.

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1. Introduction

Steve Jobs directly addressed the problem of piracy in the media industry in the interview with [Goddell \(2003\)](#): “You'll never stop [piracy]. What you have to do is compete with it”. The challenge for firms in the media industry is to identify strategies that allow them to compete at an optimal level against unlicensed usage.¹ The major players in the media industry lobby via trade associations (MPAA, IPA, and RIAA) for strict copyright enforcement and stronger punishment for piracy. However, consumers (and pirates) argue that the offered products are not optimally designed to meet their preferences ([Clement, Rangaswamy, & Vadali, 2012](#); [Economist, 2014](#)). The pressure to compete against unlicensed usage is high, especially with the advent of new online services, such as file sharing or, more recently, locker services, which allow users to widely and efficiently share media files illegally ([IFPI, 2013](#); [International Publishers Association & Börsenverein, 2012](#)).

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¹ We define unlicensed usage as any usage of media content obtained from sources that do not have the right to distribute the content to the user. This definition includes illegal usage (e.g., piracy), on the one hand, and gray areas of usage (e.g., borrowing), on the other hand, as both lead to a revenue loss for the holder of the copyright. It is therefore also not limited to digital media products.

These new technologies have substantial effects on consumer behavior (Bhattacharjee, Gopal, Lertwachara, Mardsen, & Telang, 2007; Papiés, Eggers, & Wlömert, 2011). Interestingly, prior research mainly focuses on understanding unlicensed usage and addresses the effects of digital rights management (DRM, Chellappa & Shivendu, 2005; Sinha, Machado, & Sellman, 2010; Sundararajan, 2004), legal actions (Chen & Png, 2003; Sinha & Mandel, 2008), or free services on downloading intention (Clement et al., 2012; Gopal & Gupta, 2010). However, the key questions for the industry are whether and how firms should change their marketing strategies to compete against unlicensed content distribution.

Following the argumentation of Becker (1968), in which pirates are assumed to be rational, we argue that some users knowingly consume illegitimate versions of music, movies, books, and so forth to maximize their utility. Thus, when deciding on a source of consumption, users evaluate both the costs and the expected return from illegal activities (Ehrlich, 1981). We integrate this notion into random utility theory to develop a framework for licensed and unlicensed media choice. In this model, we assume that (potential) consumers are aware of the available legal market options and the possibilities of unlicensed usage. To determine their final choice, they compare the utility of the most attractive legal alternative with the utility of consuming the product via unlicensed distribution channels and then choose the utility-maximizing option. According to this model, unlicensed users can be converted to paying customers by increasing the utility of the legal options, e.g., by reducing their prices. Then, the question arises whether firms should fight unlicensed usage by providing specific offers that maximize the utility for the relevant segments or whether they should simply accept a certain level of unlicensed usage because they will not be able to gain more business owing to cannibalization effects. In other words, should a firm care about unlicensed usage or simply ignore the “lost” segment?

To address this research question, we analyze the effects of different (1) timing and (2) pricing strategies for specific media products on consumers' choices while controlling for unlicensed usage in two major entertainment markets: motion pictures and books. We focus on pricing and timing decisions as the two main strategic instruments for applying a sequential release strategy. Both instruments play a significant role in many entertainment industries, such as the motion picture (Elberse & Eliashberg, 2003; Hennig-Thurau, Henning, Sattler, Eggers, & Houston, 2007; Ho & Weinberg, 2011) or book industry (Clerides, 2002; Hu & Smith, 2011; Kannan, Pope, & Jain, 2009), in which related or substitutable products are sold for different prices at different times (e.g., hardcover versus paperbacks versus e-books). We empirically assess the validity of the choice model and the impact of timing and pricing by using two large, representative samples of 2521 (1623) consumers in the motion picture (book) market. We use the empirical results to predict consumer choices and to simulate revenues for more than 17 million potential market configurations that differ in terms of the timing and pricing of market options. We then analyze the scenarios that provide the highest revenues for the industry, both with and without considerations of unlicensed usage.

Our results reveal that unlicensed usage has a significant effect on firm revenues, accounting for a loss of approximately one-third of firms' revenue potential. Explicitly addressing this problem by accounting for unlicensed usage through timing and pricing decisions has only a limited impact. The maximum revenue that can be achieved by accounting for unlicensed usage is not substantially different from the maximum revenue that neglects unlicensed usage, providing only a 1–2% revenue gain. Thus, from a managerial perspective, our results indicate that it is not optimal for firms to significantly change their marketing strategies to counter unlicensed usage. Overall, we find support for Becker's (1968) theoretical work that suggests that it may be optimal for firms to simply accept a certain level of unlicensed usage.

2. Literature review

The negative impact of piracy on sales has been addressed in various studies that rely either on market-level data (e.g., using natural field experiments, Danaher, Dhanasobhon, Smith, & Telang, 2010; Danaher, Smith, Telang, & Chen, 2014) or individual-level data (e.g., survey data; Sinha & Mandel, 2008). While there are some heavily debated exceptions (e.g., Oberholzer-Gee & Strumpf, 2007), most studies find strong support for the negative effects of digital piracy on sales (see the literature review by Danaher, Smith, & Telang, 2014; Dejean, 2009). However, few papers have analyzed the impact of marketing strategies to reduce the problem of piracy (Table 1).

As revealed in Table 1, previous research has addressed three major strategic options to reduce unlicensed usage. First, we find studies that analyze the impact of new laws (e.g., HADOPI; Danaher et al., 2014), the execution of laws that result in the shutdown of illegal activities (e.g., megaupload.com; Danaher & Smith, 2013), and the announcement of legal sanctions on demand (e.g., Bhattacharjee et al., 2007). The findings of these studies suggest that anti-piracy interventions reduce the level of piracy. In line with these findings, studies focusing on the link between the perceived costs of piracy (e.g., attitudes toward piracy) and the intention to pirate support the notion that taking legal actions seems to be a valid strategy to combat piracy (Lysonski & Durvasula, 2008)—ideally if it is accompanied with improved services by legal providers (Sinha & Mandel, 2008).

The second group of research focuses on technical restrictions to enforce copyrights by using digital rights management (DRM) (e.g., analytical research by Jain, 2008; Sundararajan, 2004). Using (student) survey data, Sinha et al. (2010) find that the music industry can actually benefit from removing restrictions, as a DRM-free environment increases the demand for legitimate products as well as consumers' willingness to pay for music. Thus, strong technological restrictions resulting from DRM may backfire.

A third stream of literature addresses strategies to compete with piracy by providing services for free (e.g., advertising-funded services such as Spotify). Such service interventions may change consumers' mental models regarding illegal file sharing and may result in fewer downloads of illegal music files. Based on two field experiments, Clement et al. (2012) find that the introduction of free legal music downloading services weakens the relationship between attitudes toward illegal file sharing and intention to illegally share files if the free service is of high quality. Papiés et al. (2011) argue that advertising-based business models have the potential to attract consumers who would otherwise ignore commercial downloading. Smith and Telang (2009) find that free

Table 1
Literature overview.

	Industry	Market-level data	Individual-level data	Strategic options						
				Legal actions & ethics	Copyright protection (digital rights management)	Compete via free services	Timing	Pricing	Channel	
Adermon and Liang (2014)	Music	NFE: European Union IPRED directive		X						
Danaher et al. (2014)	Music	NFE: HADOPI law in France		X						
Danaher and Smith (2013)	Movies	NFE: shutdown of Megaupload.com		X						
Bhattacharjee et al. (2007)	Music	NFE: RIAA announcement to start legal actions against P2P sharers		X						
Sinha and Mandel (2008)	Music		X	X						
Lysonski and Durvasula (2008)	Music		X	X						
Sinha et al. (2010)	Music		X		X					
Clement et al. (2012)	Music		X			X				
Papies et al. (2011)	Music		X			X				
Smith and Telang (2009)	Movies	X				X				
Ho and Weinberg (2011)	Movies		X				(X)	(X)	(X)	
Danaher and Waldfogel (2012)	Movies	X					(X)			
Smith and Telang (2013)	Movies	X					(X)			
This study	Movies & books		X				X	X	X	

Notes: NFE — natural field experiment.

movie broadcasts result in a significant increase in both DVD sales and illegal downloads for the respective movies. They suggest that “giving away content in one channel can stimulate sales in a paid channel if the free content is sufficiently differentiated from its paid counterpart” (p. 321). Overall, the results suggest that free services may convert some pirates to legal consumers. However, many content providers are struggling with the idea of changing their current business model and providing their products for free.

Previous literature provides only limited findings regarding how managers should address the problem of piracy by optimizing their product portfolio, apart from legal actions, technological copyright protection, and free service provision. Relying on a convenience sample of 193 respondents, Ho and Weinberg (2011) segment consumers of pirated movies by using a conjoint setting. They find that consumers prefer lower prices, movie theaters, and earlier access to movies. Interestingly, respondents do not prefer a legitimate version of a movie on DVD to a pirated version. Nevertheless, the study only covers a limited range of attribute levels and further does not allow analyzing the effects of a full sequential release pattern on revenues. Two additional studies have focused on the success of BitTorrent and have analyzed the negative effect of longer international release windows on sales in the motion picture industry (Danaher & Waldfogel, 2012; Smith & Telang, 2013). Both studies provide an initial indication that longer release windows may serve as a trigger for more piracy. However, as Danaher et al. (2014) note, “[...] it may be time for firms to revisit the optimality of these delayed release windows given the presence of pirated content” (p. 34).

3. Conceptual model for media choice and unlicensed usage

Becker's (1968) economic approach to analyzing social issues provides the framework for our model. According to his theory, both legal and illegal actions have an expected utility. Criminals can therefore be considered rational because their expected utility of an offense exceeds the utility of legal alternatives. Applied to our research context, the theory suggests that pirates consume media illegally because the utility of unlicensed usage, i.e., the net benefit of media consumption and the probability of being penalized, exceeds the utility of the market offerings. If this theory of rational choice holds, then increasing the attractiveness of the legal options would diminish the relative advantage of pirated media and, consequently, would decrease the probability that consumers choose unlicensed usage.

The notion of utility-maximizing behavior can be represented by random utility theory (McFadden, 1974; Thurstone, 1927). The theory states that the utility U of a legal option j or an unlicensed option Ω is a latent construct that can be approximated

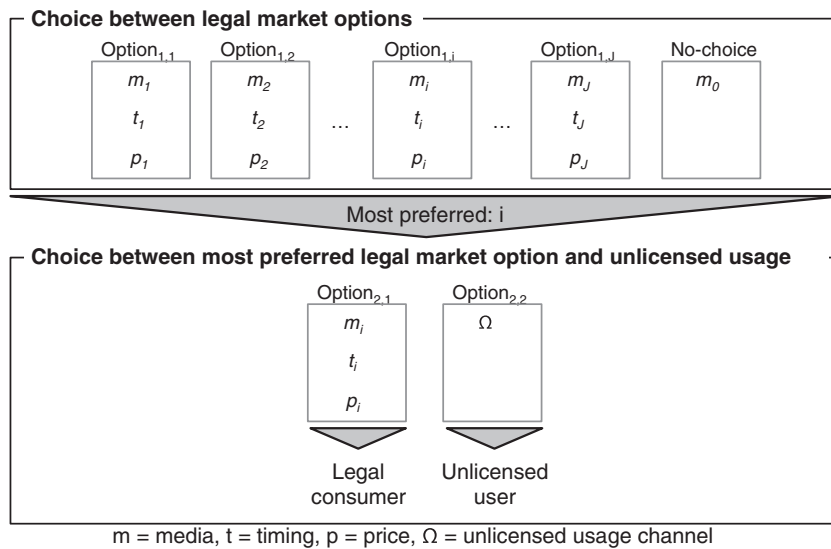


Fig. 1. Conceptual framework of media and unlicensed usage choice.

by a systematic, explainable component V and a random, unexplainable error term ε , such that $U = V + \varepsilon$. We assume that the systematic utility of a specific media product j is a function of its media type m_j (e.g., movie theater, DVD, Blu-Ray for movies; hardcover, paperback, e-book for books), its release time t_j , and the price that has to be paid p_j . Consequently, the systematic utility can be expressed as a combination of part-worth utilities β for each of these attributes, i.e., $V_j = \beta_m m_j + \beta_t t_j + \beta_p p_j$.

Since unlicensed usage is beyond the immediate control of the media industry, we leave the description of these channels latent in our model and do not assume a specific media type or timing. Moreover, because the type of unlicensed usage and the perceived risk are very likely to be heterogeneously distributed across consumers and decisions, we do not account for different utility components, i.e., the positive utility of consuming the media and the negative utility of the risk of being penalized. We therefore only measure the preference for each consumer that represents the net utility of unlicensed usage, i.e., $V_\Omega = \beta_\Omega \Omega$.

To identify the utility function, we systematically vary the legal market options within a conjoint choice experiment. Specifically, our conceptual model and experimental procedure consist of two parts (Fig. 1). We assume that consumers (including potential users of unlicensed media) are aware of the media alternatives that are legally available on the market and that they would be able to identify their most preferred option i from a set of J alternatives. In the market scenario J we also consider a constant option to not choose any of the alternatives if none of them is attractive for the consumers so that they would not be willing to spend their money on either of them. This option can be interpreted as, e.g., waiting until a movie becomes available on TV, which has no immediate financial consequences (Hennig-Thurau et al., 2007). Formally, we treat this no-choice option as another level of media type, i.e., $V_0 = m_0$. Since timing and price of this option are not varying they do not have to be specified in its systematic utility.

The first part of our framework is essential for our research since it allows us to analyze how the different media attributes affect preferences for the legal market options, even if the consumer ultimately prefers unlicensed media. Explicitly modeling the preferences of unlicensed users for legal options is needed in our research context to assess the demand potential that is lost.

To consider unlicensed usage and to determine the final mode of consumption, we assume that a consumer compares the most preferred legal alternative i with the utility of consuming a product via unlicensed channels Ω and chooses the utility-maximizing option. That is, there are always only two options in this second step: 1) the chosen option of the first step and 2) unlicensed usage. If a consumer purchases the legal market option i , this leads to revenue p_i for the industry (unless the consumer has chosen the no-choice option in the first step, i.e., $i = 0$). Alternatively, if the consumer decides to use unlicensed media, this revenue potential is lost.²

² Imagine that there are three legal options on the market (a, b, c) and an unlicensed option Ω . A one-step approach would only indicate that a user of unlicensed media would choose Ω . However, we need to know the revenue potential that is lost, i.e., which of a, b, or c is preferable. The two-step approach allows us to observe both choices, i.e., which of a, b, or c is most preferred and whether this alternative would still be chosen given the availability of unlicensed usage. Overall, our conceptual framework mimics a dual response choice design, which has been shown to increase the efficiency of the estimation and to improve the validity of the results, especially in our case where there is a possibility that many respondents would choose unlicensed media in the first place (Brazell et al., 2006; Wlömert & Eggers, 2014). However, the sequential choice process might bias the results since pirates do not explicitly consider two separate decisions. We address this issue in more detail in the [Limitations and further research](#) section.

As an example in the movie context, consider that a consumer has chosen a Blu-Ray that is available three months after the theatrical release for €20 from all available alternatives in the first step. In the second step, the consumer needs to compare the attractiveness of this option with the attractiveness of unlicensed usage. If the consumer chooses the Blu-Ray also in the second step the industry will gain €20 in revenue. If another consumer chooses the no-choice option in the first step the industry will not benefit financially (neglecting potential license fees from a TV broadcast), irrespective of the consumer's choice in the second step. However, if this consumer prefers unlicensed media to waiting for the TV release in the second step this will become apparent in a higher market share of unlicensed usage in our model.

We integrate the observed choices into a multinomial logit (MNL) model (Louviere, Hensher, & Swait, 2000).³ The logit formula models preferences β for the media attributes in terms of choice probabilities *prob*; i.e., preferring movie option *i* in the set of *J* alternatives is integrated into the likelihood function as given in Eq. (1):

$$prob(i|J) = \frac{\exp(\beta_m m_i + \beta_t t_i + \beta_p p_i)}{\sum_j \exp(\beta_m m_j + \beta_t t_j + \beta_p p_j)} \quad (1)$$

If unlicensed channels are available, the consumer compares the most preferred legal option with unlicensed usage. Thus, to account for the second part of the conceptual framework, we relate the attractiveness of the preferred option *i* to the attractiveness of consuming the media option via unlicensed channels Ω . The probability that consumers choose unlicensed media instead of purchasing *i* is given in Eq. (2):

$$prob(\Omega|\{i, \Omega\}) = \frac{\exp(\beta_\Omega \Omega)}{\exp(\beta_m m_i + \beta_t t_i + \beta_p p_i) + \exp(\beta_\Omega \Omega)} \quad (2)$$

These choices can then be integrated as components into the likelihood function *L* of our model to estimate media preferences β across consumers *n* and choice occasions *c*:

$$L = \prod_n \prod_c prob(i_{n,c}|J_c) \cdot prob(\Omega|\{i_{n,c}, \Omega\}) \quad (3)$$

After preferences have been estimated, the MNL function can be used for prediction purposes. For the subsequent analyses, we multiply the predicted choice probabilities for each medium (with and without an unlicensed usage correction) by the corresponding price to derive a revenue measure *R*:

$$R(i|J) = \frac{\exp(\beta_m \cdot m_i + \beta_t \cdot t_i + \beta_p \cdot p_i)}{\sum_j \exp(\beta_m \cdot m_j + \beta_t \cdot t_j + \beta_p \cdot p_j)} \cdot p_i \quad (4)$$

We are then able to compare the value of a market scenario *J* by its expected revenue, given as the sum of *R* across the *J* alternatives. A scenario is less valuable (1) if consumers are able to choose their preferred media product for a price that is lower than their willingness to pay, (2) if the scenario contains no attractive options such that the consumers choose the no-choice option, or (3) if consumers prefer unlicensed usage instead of buying the legal option. The last scenario is accounted for by an unlicensed usage correction factor for each option *i*, which is given by *prob*(*i* | {*i*, Ω }).

We consider revenue, i.e., the value of the overall market, to be an appropriate measure to evaluate the effect of unlicensed usage, as opposed to profit, because the different market players are collectively competing against unlicensed usage. Moreover, our revenue measure is insensitive to additional assumptions about costs or concessions required for calculating profits (nevertheless, we contrast our findings with profit optimizing scenarios, see footnote 6). However, this approach is also not without caveats (e.g., the industry also generates revenue from merchandising that is not included in our model), which we acknowledge as a limitation of this research.

³ The MNL model assumes independence of irrelevant alternatives (IIA). Statistically, IIA arises from the properties of the error distribution in the MNL model, which assumes that alternatives in a choice set are uncorrelated. The sequential choice model that we apply relaxes this assumption to some extent since we model the piracy option not as an additional alternative but as an additional choice set (which is represented with an additional error observation). Moreover, we do not estimate the MNL model with an aggregate-level maximum likelihood procedure but use a hierarchical Bayes mixed logit model that relaxes the IIA assumption further (Train, 2009). Following the idea of the Hausman–McFadden test (Hausman & McFadden, 1984), we conducted two estimations in which we included/excluded the sequential choice sets. The parameters of both models are highly correlated (correlation movies = 0.982, correlation books = 0.946), suggesting that we can assume IIA in our application.

4. Empirical application

In the subsequent empirical application, we use the revenue measure described above to assess how much value is lost in a scenario because of unlicensed usage.

4.1. Experimental design

Both the movie and the book studies examined media type, timing, and pricing as varying attributes (Table 2). For the book study, we used media-specific prices (see Online Appendix Table O1). We applied an alternative-specific, experimental, conjoint choice design in which the choice sets consisted of five options (Louviere & Woodworth, 1983). To represent a realistic scenario, each set included one option that provided the anchor for timing, i.e., movie theater or hardcover book. Additionally, we included a constant no-choice option that could be selected if none of the alternatives was attractive. The implication of choosing this option is that the consumers are not willing to spend their money on either option. In the movie study, we worded the no-choice options as follows: “I would wait until the movie is shown on TV for free”. Since such a free broadcast is not available for books the implication of no-choice in this context is that the consumer will not read the book at all. The remaining three options in each choice set were selected randomly but were controlled for balance and minimal overlap. Consequently, each media format was only shown once in each choice set, and all (media-specific) timing and pricing levels were presented equally often across all choice sets (Huber & Zwerina, 1996; Kuhfeld, Tobias, & Garratt, 1994).

To consider the effect of unlicensed usage, each choice task asked for the first choice and, consecutively, assessed whether the consumer would actually stick to the selected media product (including the no-choice option) if an unlicensed option was also available. The specific wording for this sequential choice was as follows: “If there was another way to obtain the movie (book), e.g., via friends, colleagues, or research on the internet, would you stick to your choice?” We intentionally used a latent formulation and did not explicitly mention the words “illegal” or “piracy” to avoid a social desirability bias. Given this more general focus and the assumption of availability, it has to be acknowledged that our results represent worst-case scenarios for the industry in terms of revenue loss (see also the Limitations and further research section for a more extensive discussion how these aspects might influence the results).

In both applications, the choice design consisted of 12 choice sets that were used for the estimation and one holdout set that was used to assess the predictive validity of the estimates. To increase the realism of the choice task, each choice pertained to a specific movie or book author that the respondent had previously selected in the survey. Consequently, following Hennig-Thurau et al. (2007) and Ho and Weinberg (2011), we use the movie or book selected by the individual as our unit of analysis. Thus, we focus on marketing alternatives to item-specific (movie- and book-level) strategies.

4.2. Samples

We surveyed two German quota samples that were invited from a professional online panel in 2011. Screening questions ensured that only consumers who had purchased at least one of the target media types in the last 12 months could enter the survey. After respondents who answered the survey in an unrealistically short time were excluded, a total of $n = 2521$ and $n = 1623$ respondents remained for the analysis in the movie and book studies, respectively. The gender and age distributions for both

Table 2

Attributes and levels for the movie study and the book study.

Media type	Timing	Pricing
<i>For movies</i>		
Movie theater	Same as theatrical release	€3
DVD purchase	1 month after theatrical release	€5
Blu-ray purchase	1 1/2 months after theatrical release	€8
DVD or Blu-ray rental	2 months after theatrical release	€10
Download-to-rent, HD quality	3 months after theatrical release	€12
Download-to-rent, SD quality	4 months after theatrical release	€15
Download-to-own, HD quality		€20
Download-to-own, SD quality		€25
		€30
<i>For books</i>		
Hardcover	1 month before hardcover release	€3
Paperback	Same as hardcover release	€5
E-book purchase, copy protected file, not shareable	6 months after hardcover release	€8
E-book purchase, copy protected file, shareable	12 months after hardcover release	€10
E-book purchase, no copy protection, shareable		€12
E-book rental (3 months), copy protected file, not shareable		€15
		€18
		€20
		€25
		€30

Table 3
Descriptive statistics.

	Share in movie study	Share in book study	National Share ^a	Share of cinema visitors ^a	Share of book buyers ^b
Male/female	38%/62%	48%/52%	49%/51%	45%/55%	43%/57%
Age					
<30 years	31%	17%	25%	51%	24%
30–39 years	28%	23%	17%	16%	15%
40–49 years	28%	26%	23%	16%	20%
>49 years	13%	34%	35%	17%	41%
Income (median)	€2000–3000	€1.501–2.000	€900–1.500	/	/
Persons in household (median)	2	2	1	/	/

^a FFA, 2011, p. 15f. and p. 36.

^b Börsenverein, 2011, p. 24.

data sets are comparable to those for the overall market of movie goers and book buyers in Germany (Table 3, Börsenverein, 2011; FFA, 2011). The data sets also reveal differences between the two industries. The main target group of the movie industry is relatively young (e.g., age < 30), whereas the book market appeals mostly to older people (e.g., age > 49).

4.3. Estimation and validity

To capture heterogeneity among respondents in the estimation, we applied a hierarchical Bayes (HB) procedure with mixtures of normal distributions because it allows for individual-level estimates (Lenk, DeSarbo, Green, & Young, 1996; Rossi & Allenby, 1993; Rossi, Allenby, & McCulloch, 2005; Rossi & McCulloch, 2006). In the HB routine, we set 10,000 preliminary iterations to achieve convergence and 10,000 subsequent iterations to draw preference estimates. Visual inspection of the time series confirmed that the procedure converged after the burn-in phase (a summary of the part-worth estimates can be found in the Online Appendix, Tables O2 and O3). The fit values indicate that the observed choices are well represented by the estimation model, i.e., based on root likelihood values (RLH) of the estimation ($RLH_{\text{movies}} = 0.732$, $RLH_{\text{books}} = 0.766$) and uncertainty explained U^2 (Kalwani, Meyer, & Morrison, 1994; $U^2_{\text{movies}} = 0.806$, $U^2_{\text{books}} = 0.834$).

Before we use the preference estimates in our revenue model, we need to make sure that the estimates are able to represent and predict the actual choices of consumers. Consequently, we compare the actual choices in the holdout sets with the predicted choices of the model to assess the hit rate of correct predictions and mean absolute error between observed and predicted choice shares (MAE; Moore, 2004; Moore, Gray-Lee, & J., L. J., 1998). In the holdout scenario, the movie theater option is the most preferred alternative, with 75.8% of the respondents choosing this alternative. The predicted value is 71.9%, leading to an absolute error of 3.9% points. Across all alternatives, the MAE is 2.96% points (see Online Appendix O4 for details). On an individual level, 81.8% of the choices are predicted correctly (vs. 20% in a chance model). Both the MAE and the hit rate indicate the high validity of the model and are comparable to the results of Hennig-Thurau et al. (2007). Including unlicensed usage, the actual and predicted shares are reduced significantly; e.g., only 52.9% of the respondents, instead of 75.8%, would watch the movie in theaters. The validity of this unlicensed usage correction is high; the MAE between the actual and the predicted shares is improved to 1.36% points, and 87.6% of the individual choices are predicted correctly (vs. 50% in a chance model).

To apply the revenue model (Eq. (4)), we multiplied the shares of each option with its price in the scenario. This results in a revenue of $.758 \times \text{€}8+.012 \times \text{€}20+.027 \times \text{€}20+.073 \times \text{€}12 = \text{€}7.72$. Because this revenue value is based on shares, it can be interpreted as the expected value of one purchase decision between the given alternatives. Using the predicted shares as a basis for the calculation leads to a revenue of €6.87, i.e., a –11.0% deviation from the actual choices. If unlicensed usage options are available, these revenue measures are reduced to €5.36 (actual) and €5.00 (predicted; –6.7% deviation). In this scenario, 30.6% (actual) and 27.2% (predicted) of the revenue potential is lost because of unlicensed usage. We observe the strongest media type-specific loss in the DVD purchase channel (–35.6%) and the lowest effect of unlicensed usage in the Blu-Ray purchase channel (–25.9%).

The measures in the book study also support the high predictive accuracy of our model (see Online Appendix O4). The prediction has a low MAE of 1.34% points (.78% points with unlicensed usage correction) and a high hit rate of 74.5% (20% in a chance model). Unlicensed usage is predicted correctly in 91.3% of the cases (50% in a chance model). The calculated revenues for the shares in the holdout scenario are €10.60 based on the actual choices and €10.73 based on the predicted choices (+1.2% deviation). These revenues are reduced to €7.60 (actual) and €7.68 (predicted; +1.1% deviation); leading to a loss of 28.3% (actual) and 28.4% (predicted) owing to unlicensed usage. The media type-specific losses indicate that the cannibalization due to unlicensed usage strongly differs between physical versions of books (hardcover: –21.0%; paperback: –29.5%) and digital versions of books (e-book purchase: –46.2%; e-book rental: –50.0%). Thus, we find that the negative demand consequences of unlicensed usage are substantially stronger for digital versions of books.

Overall, the media type-specific losses show high face validity and are consistent with other findings in the piracy literature. Ho and Weinberg (2011) report a piracy rate of 37.3% among all the respondents in their sample with respect to DVDs and downloads. Peitz and Waelbroeck (2004) report that the effect of piracy on physical music sales across 16 countries is –20%, which

Table 4

Alternative shares for the top 10% of the scenarios (in %; standard deviation in parentheses) for movies and books.

	Shares when ignoring unlicensed usage	Shares when considering unlicensed usage
<i>For movies</i>		
Movie theater	44.2 (12.8)	36.0 (8.9)
Disc purchase	11.5 (12.6)	7.1 (7.3)
Rental	2.5 (3.3)	1.3 (1.6)
Download-to-own	3.2 (4.1)	1.7 (2.1)
(No choice)	38.6 (6.5)	18.3 (3.2)
Unlicensed usage	–	35.5 (2.8)
<i>For books</i>		
Hardcover	23.5 (16.8)	17.9 (12.9)
Paperback	36.1 (17.0)	26.7 (12.6)
E-book purchase	5.4 (3.5)	3.5 (2.6)
E-book rental	3.5 (2.5)	2.0 (1.7)
(No choice)	31.5 (5.7)	13.6 (2.7)
Unlicensed usage	–	36.2 (2.2)

is also supported by Zentner (2005), who reports values between -6% to -24% . Newer cross-country studies regarding the effect of piracy on sales in the music industry report effect sizes between -20% and -56% (Liebowitz, 2008) and between -25% and -27% (Pons & Garcia, 2008).

As another measure of face validity, we calculated price and timing elasticities in both studies by estimating the demand for the holdout scenarios⁴ and manipulated the pricing and timing of each channel *ceteris paribus* (see Table O5 in the Online Appendix). For movies, our price elasticities range between -1.18 (download-to-rent) and -1.51 movie theater. These values are comparable to previous findings. de Roos and McKenzie (2014) report weekly “promotional” price elasticities in Australian cinemas of about -2.3 . Luan and Sudhir (2010) report a price elasticity of -1.84 for DVDs with respect to ad responsiveness. In the book market, we find published price elasticities for physical books that range between zero and -9.8 , whereas most studies find ranges between -1.3 and -3.5 (Brynjolfsson, Dick, & D., S. M., 2010; Chevalier & Goolsbee, 2003; Clerides, 2002; Ghose, Smith, & Telang, 2006; Hjorth-Andersen, 2000), which is in line with the price elasticities of our study that range between -1.35 (e-book purchase) and -3.00 (paperback).

We identify only a few papers that report timing elasticities as there is only little variance in timing decisions observed in the market that can be used to estimate a market response model (see also Lehmann & Weinberg, 2000). However, Luan and Sudhir (2010) report a delay elasticity of -0.1 for DVDs (compared to the cinema release). This is comparable to our result of -0.19 (see Table O5 in the Online Appendix for details).

4.4. Revenue optimization with pricing and timing

To compile a more complete picture of the demand behavior given different timing and pricing settings and the resulting loss due to unlicensed usage, we applied the revenue model to a large number of scenarios. For movies, we considered all scenarios with the following five options: (1) movie theater, (2) disc purchase (DVD or Blu-Ray), (3) rental options (DVD or Blu-ray rental, download-to-rent in SD or HD), (4) download-to-own (in SD or HD), and (5) the no-choice option (TV). Given the different possible timing and pricing combinations for these options, this leads to 9 (movie theater) \times 108 (disc purchase) \times 162 (rental options) \times 108 (download-to-own) scenarios, i.e., a total of 17,006,112 scenarios. Similarly, for books, we considered combinations of all four media types in addition to the no-choice option, resulting in 7 (hardcover) \times 28 (paperback) \times 96 (E-book purchase) \times 24 (E-book rental) scenarios, i.e., a total of 451,584 scenarios.

4.4.1. Movies

The maximum revenue for movies across all scenarios is €8.57 (ignoring unlicensed usage). This amount is reduced to €5.75 due to unlicensed usage, which equals a 32.9% loss. When maximizing the revenue that explicitly considers unlicensed usage, the maximum that can be obtained is €5.82, which equals a 1.2% increase. To analyze these results further, we selected the top 10% of all scenarios based on overall revenue (“ignoring unlicensed usage”) and compared the settings and results with the top 10% of the scenarios based on unlicensed usage-corrected revenue (“considering unlicensed usage”). Ignoring unlicensed usage, the average (corrected) revenue is €5.38. Explicitly optimizing the unlicensed usage-corrected revenue increases this value by only 1.1% to €5.44.

Table 4 shows the relative shares of the alternatives in the top 10% of the scenarios. In the movie context, most of the revenue is generated by movie theaters, which is the most attractive alternative, with an average share of 44.2%. The second most preferred

⁴ In the holdout scenario, movies are released first in movie theaters for €8, two months later as download-to-rent in HD quality for €20, three months after the theatrical release on Blu-Ray for €20, and four months after the initial release as a DVD purchase option for €12. In the book market, we assumed a scenario in which hardcover books cost €18 and are released simultaneously with e-book purchases that have no copy protection and e-book rentals that are copy protected. E-book purchases are offered for €10 and e-book rentals for €5. One year after the initial release, paperback books are offered for €12. In both industries the no-choice option was considered.

option is disc purchases and an average of 11.5% of the consumers would purchase this alternative. Rental and download-to-own options follow with 2.5% and 3.2%, respectively. The remaining 38.6% represent consumers that would not choose any of the alternatives in the top scenarios.

Fig. 2A shows the relative frequency of the different price levels in these scenarios for movie theaters (across all scenarios, the appearance of attribute levels is balanced). The scenarios that are most likely to lead to high revenues for movie theaters are those in which tickets are priced between €12 and €15. To address unlicensed usage, it is better to lower prices to €10–12. However, the increased demand through converted consumers who would otherwise prefer unlicensed usage cannot compensate for the relative loss due to lower prices, and the impact on overall revenue is limited (see the previous section). For the other media options, pricing is less influential; i.e., the price levels are distributed more evenly, and no notable difference exists between the optima that ignore and consider unlicensed usage. However, there is evidence that prices below €9 should be avoided because they are under-represented in the top 10% of the scenarios (see also Fig. O1, Online Appendix).

Regarding timing, there is a notable negative relationship between the timing of disc purchases and the probability of high revenues (Fig. 2B). Earlier releases (closer to the theatrical release) increase the attractiveness and, therefore, the demand for disc purchases, which then leads to higher sales. However, no notable differences arise between the optima that ignore and consider unlicensed usage; i.e., earlier releases cannot attract additional consumers who would otherwise demand unlicensed alternatives. For the rental and download-to-own options, the timings are distributed equally across the top 10% of the scenarios; i.e., the revenue optimum is not sensitive to the timing of these options (see Fig. O1, Online Appendix).

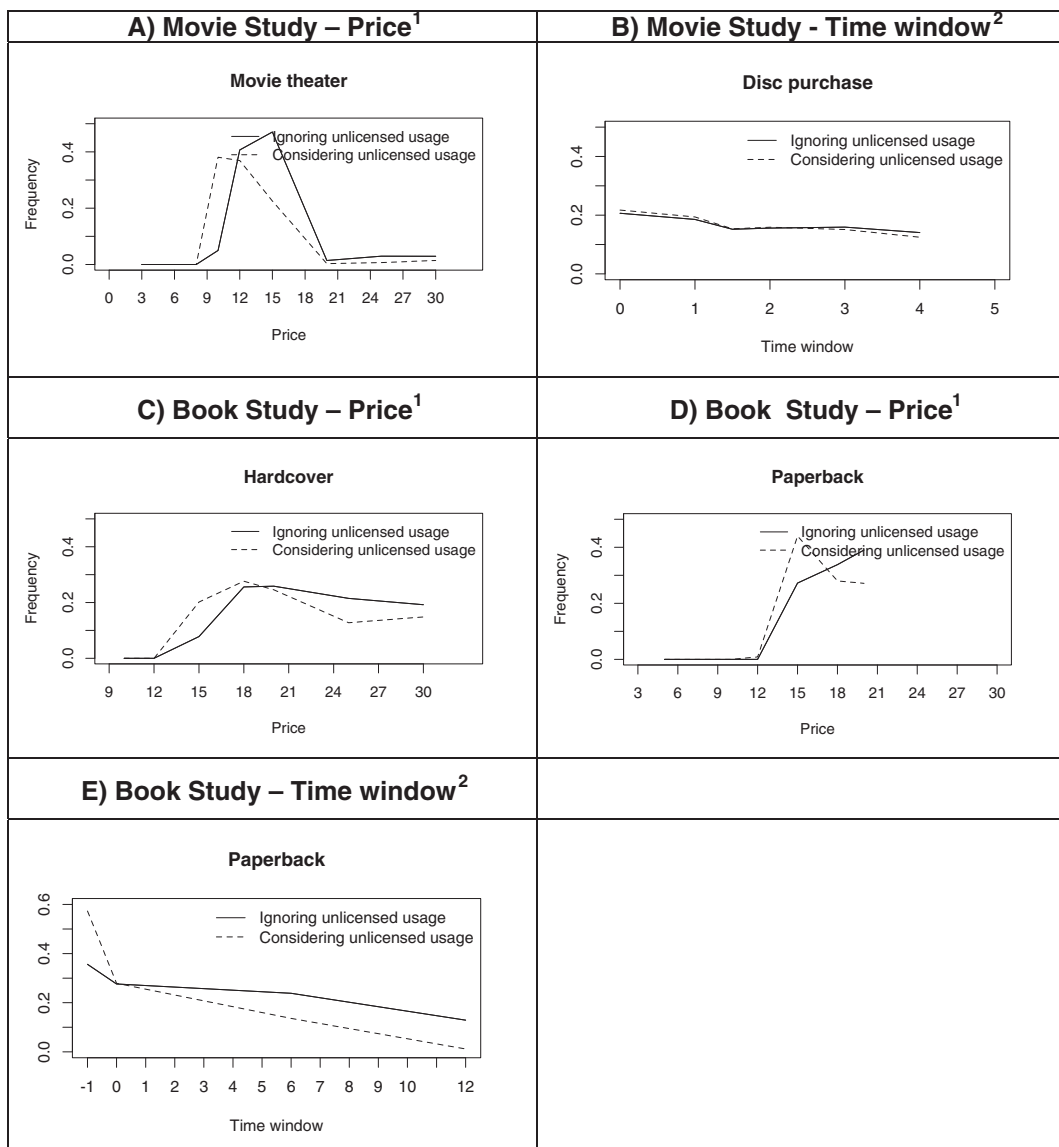


Fig. 2. Relative frequency of attribute levels in the top 10% of the scenarios. ¹ = in Euro. ² = in months.

In line with these findings, in the overall best scenario that ignores unlicensed usage movie theater tickets cost €15, leading to a market share of 32.8% (23.2% corrected when including unlicensed usage). Disc purchases are released simultaneously with movie theaters for €12 (26.7% share, 16.7% corrected). Download-to-rent is also offered at the initial release date, however, for a premium price of €30 (0.9% share, 0.7% corrected). Download-to-own should be priced equally high but released three months later (0.8% share, 0.7% corrected).⁵ This scenario accepts that 38.8% of the consumers do not buy any of the media options but would wait for a TV release. There are three differences in the overall best configuration that addresses unlicensed usage: Theater prices are reduced to €12 (40.4% share, 29.4% corrected) and disc purchase prices to €10 (29.2% share, 19.4% corrected); downloading to rent should be postponed by one month (1.0% share, 0.7% corrected). This configuration decreases the share of consumers willing to wait for a TV release to 28.7%.

Scenarios that are similar to the status quo, in which disc purchases are released later for higher prices and downloading options are released later but cheaper, are also represented in the top 10% scenarios. However, these scenarios only lead to a maximum revenue of €7.61 (−11.2% compared to the overall maximum revenue) that is reduced to €5.39 when unlicensed usage is considered (−7.4%). Consequently, despite the fact that timing and pricing cannot substantially reduce unlicensed usage, optimizing these elements is effective in creating more value to the industry.

4.4.2. Books

Interestingly, although the book industry is structurally different from the movie industry, the relative loss due to unlicensed usage is similar. The maximum revenue of €12.40 (ignoring unlicensed usage) is reduced to €8.35 if unlicensed media are available (−32.7%). Optimizing the unlicensed usage-corrected revenue leads to a maximum revenue of €8.50, i.e., a 1.8% gain. On average, €8.05 of unlicensed usage-corrected revenue is generated in the top 10% of the scenarios that ignore unlicensed usage, and €8.14 is generated in the scenarios that consider unlicensed usage, which equals just a +1.1% increase. Hardcover and paperback books are the dominant options in the top 10% scenarios, with average shares of 23.5% and 36.1%, respectively. E-books are only a niche market in the top 10% of the scenarios, with an average share of 5.4% (purchase) and 3.5% (rental) (see Table 4).

Fig. 2C and D shows the relative frequencies of the prices in the top 10% scenarios that consider or ignore unlicensed usage. The results demonstrate that when hardcover books are priced over €18 and when paperbacks are between €15 and €20, it is more likely that these scenarios will generate high sales (when unlicensed usage is ignored). Lower prices are more effective when unlicensed usage is addressed; i.e., in the optima that consider unlicensed usage prices between €15 and €20 for hardcover books and paperback books for €15 are more frequently observed. The prices for the e-book options are less influential (see Fig. O2, Online Appendix).

Regarding timing, earlier releases of the paperback are generally more likely to lead to higher overall revenues (see Fig. 2E). This relationship is even more distinct when unlicensed usage is considered: in 57.3% of the scenarios, the paperback is released before the hardcover. Releasing the paperback earlier makes this option more attractive and reduces unlicensed usage. Nevertheless, this strategy also substitutes demand for the higher-priced hardcover books, which levels out the effect on overall revenue. Timing for digital media and rental options is generally less relevant, which is consistent with the results for the movie study (Fig. O2, Online Appendix).⁶

In the overall most attractive revenue scenario that ignores unlicensed usage paperback books are priced at €20 and are released one month before hardcover books, leading to an overall share of 30.7% (19.3% corrected for unlicensed usage). Hardcover books are priced equally at €20 (26.1% share, 19.6% corrected). Thus, the premium quality of the hardcover book is balanced with a later release, leading to less price differentiation. E-book purchases are released simultaneously with the hardcover books and priced at €18 (4.1% share, 2.3% corrected). E-book rentals follow 12 months after the hardcover release for €12, resulting in 2.6% share (1.2% corrected). In total, this scenario accepts that 36.5% of the consumers would not choose any of these options. The only differences in the overall best scenario that considers unlicensed usage are in pricing; timings remain unchanged.

⁵ The results suggest that higher prices for the downloading options lead to higher revenues. This result appears to be counterintuitive because the demand is elastic for these media types. However, there are positive cross-price effects such that the higher prices increase the demand for the remaining alternatives; e.g., higher download-to-own prices increase the market share for movie theaters. The low market shares of the downloading options reflect this effects i.e., the high prices are used to drive sales for the remaining options.

⁶ We conducted additional simulations for the book market that consider the marginal costs for the different book types, as we received information about marginal costs from an industry manager that wishes to stay anonymous. The industry in Germany typically calculates the costs relative to the selling price: (a) value-added tax: 7% for hardcover/paperback, 19% for e-books, (b) retailer commission: 45% for hardcover/paperback, 35% for e-books, (c) author's royalty: 10% for all book types, (d) manufacturing: 10% for all book types, (e) marketing: 7% for all book types, (f) distribution: 8% for all book types (g) cost of returns: 4% for all book types, and (h) DRM costs: €0.20 for DRM-protected e-books. We used this setting for calculating profits for each scenario. Since it is not reasonable to assume that manufacturing costs change when only the price is adjusted, we added fixed costs for printing hardcover and paperback books, i.e., €2.50 (Rich, 2010). With this additional fixed cost—and when we increase this amount further—the simulations show that the optimal profit configurations consist of scenarios in which hardcover and paperback books are priced higher than in the revenue optima. In fact, for both printed book types, their highest price is the most frequently observed price in the top 10% of the profit configuration (34.5% of the scenarios consist of hardcover books for €30, and in 62.7% of these observations, paperbacks are priced at €20). The same holds for the timing implications of paperback books, which generally exhibit a longer window in the profit configurations than the shorter window from the revenue perspective. The explanation for this observation is that with higher printing costs, the demand is shifted to the e-book options that exhibit a higher margin. Most importantly, however, the profit scenarios that consider unlicensed usage and those that do not consider unlicensed usage are almost identical (correlation of .99). Consequently, if media production firms are merely interested in maximizing their profits (instead of collectively fighting with distributors against unlicensed usage), explicitly accounting for unlicensed usage is even more ineffective.

Specifically, hardcover and paperback books are both priced lower at €18, leading to a share of 30.4% (hardcover, 22.4% corrected) and 33.6% (paperback, 21.7% corrected). The demand increase for these options is supported by a price increase for e-book purchases to €20, which drives demand away from this option (2.7% share, 2.0% corrected). E-book rentals are priced at €12 as in the scenario that ignores unlicensed usage (2.5% share, 1.2% corrected). The lower prices of hardcover and paperback books make this scenario more attractive so that only 30.8% of the consumers would not choose any of these options. Nevertheless, the increase in demand cannot counteract the lower price level so that the overall gain in (unlicensed usage-corrected) revenue remains limited.

The current status quo consists of hardcover books that are released first for about €20–25, simultaneously with e-book purchases for €18–20, and paperback books and e-book rentals are offered one year later for €12–15 and €8, respectively. This scenario generates revenues of €11.82 (–4.6%) that are reduced to €7.93 (–6.7%) due to unlicensed usage. Thus, similar to the movie industry, also in the book market optimizing timing and pricing is a promising approach, even though it is limited in addressing unlicensed usage.

5. Conclusions

The music industry has been the initial case study to learn about unlicensed usage. Although some authors have not been able to provide empirical support for the negative effects of file sharing on music industry sales (e.g., Oberholzer-Gee & Strumpf, 2007), the majority of the findings indicate that the media industry faces significant challenges and losses due to piracy (Danaher et al., 2014; Dejean, 2009). One way to address this challenge is to change the marketing activities to “lure” pirates back to the legal track (Sinha & Mandel, 2008).

In our research, we address whether it is worth the effort to focus on unlicensed usage. To answer this question, we introduce a choice model for media products in which we account for unlicensed alternatives. This choice model predicts the revenues for different media options based on their (unlicensed usage-corrected) choice shares. In two large-scale empirical studies, we tested the model in the context of consumers' movie and book choices. Although these industries are quite different, consumer reactions toward unlicensed usage are consistent across both contexts. This finding is interesting because the price levels (which are higher in the book market), the target audience (which is older for the book market), and the novelty of digital product versions (which are newer in the book market) differ between the two markets. The results indicate that approximately 1/3 of the total revenue potential is lost, demonstrating that unlicensed usage has a substantial effect in both industries. This finding corresponds well with reports from the music industry in which the global recorded music revenues declined by 31% between 2004 and 2010 (IFPI, 2011). Piracy has been noted to be one of the major drivers of the immense loss in sales (GfK, 2011; IFPI, 2012; Vernik, Purohit, & Desai, 2011).

Explicitly addressing this problem by optimizing the unlicensed usage-corrected revenue through timing and pricing decisions has a limited impact. The maximum revenues are not significantly different from simply ignoring unlicensed usage and only increase by 1–2%. Despite having no substantial effect on revenue, considering unlicensed usage can still be beneficial since some consumers who prefer unlicensed usage can be converted to paying customers so that the overall share of unlicensed users is reduced. Moreover, our analyses show that the status quo timing and pricing configuration is not optimal so that optimizing the marketing mix is a promising way to create value for both industries.

We provide new insights for managers in the entertainment industry and for regulatory authorities. The fact that the industry will not be able to regain the revenue lost from unlicensed usage via traditional marketing efforts highlights the dilemma of the industry in general. Because our model assumes that unlicensed usage channels are available when consumers make a decision, an effective way to reduce unlicensed usage is to regulate the market and to decrease the expected utility of unlicensed usage.

6. Limitations and further research

Central to our analysis is the way we model unlicensed usage. The measures we have applied might either overestimate or underestimate the share of unlicensed usage (Table 5).

We might overestimate the share because we focus on unlicensed usage in general, which might include legal ways of borrowing, instead of focusing specifically on illegal piracy. Moreover, we assume that unlicensed options are available, which might not be true for every purchase decision. Relatedly, our dual response procedure is making the unlicensed usage option more salient,

Table 5

Overestimation or underestimation of unlicensed usage.

Overestimation of unlicensed usage	Underestimation of unlicensed usage
<ul style="list-style-type: none"> - General focus on unlicensed usage instead of piracy which is broader in scope - Assumption of availability of unlicensed usage - Dual response procedure is making the unlicensed usage option more salient - Neglecting multiple consumption 	<ul style="list-style-type: none"> - Socially desired responses - Focus on item-specific strategies: higher interest in selected movie/book that corresponds with less unlicensed usage.

although the consumer might not have considered it otherwise. We ran a validation study to empirically analyze whether our two-step approach ($n = 200$) leads to different choices than an approach in which consumers simultaneously decide between legal and unlicensed options ($n = 203$). The results are mixed. For movies we find that the two-step approach indeed inflates the shares for unlicensed usage ($p = .066$), while there are no significant differences in the book study ($p = .724$; see Online Appendix: Validation study, Tables O6 and O7). Shares for unlicensed usage might also be inflated because we neglect multiple consumption decisions. Accordingly, cases where consumers choose unlicensed media first and, if they liked the movie or book, are more inclined to buy a legal copy afterward (i.e., the “sampling argument”; see, e.g., [Smith and Telang \(2009\)](#)) are not considered in our scenarios.

On the other hand, we might underestimate unlicensed usage if (some) responses in our experiment are still influenced by social desirability, despite the measures we have taken. In our validation study (within-subjects in the two-step condition, $n = 203$), we also tested additional wordings of the sequential choice question. Specifically, we tested wordings that signaled clear illegal piracy. The comparison indicates that the choice shares for both the movie and the book market do not differ significantly between our wording and a clear illegal formulation ($p = 0.364$ (movies), $p = 0.114$ (books), χ^2 test). However, we do find a significant increase in shares for unlicensed usage when using a clear legal wording ($p < 0.001$ (movies and books), χ^2 test). There are two potential explanations for this result. First, it could be that consumers interpret unlicensed usage to resemble piracy or, second, that consumers are still affected by social desirability, which therefore qualifies for further research.

Moreover, our study follows an item-specific perspective in that consumers want to watch one specific movie (or read one specific book) and can choose between different formats. While we find this notion realistic and appropriate for modeling unlicensed usage in most situations, it does not include scenarios in which the consumer simply wants to be entertained and would be willing to consume alternative movies (books). In this case, consumers can switch to not only a different format but also a different movie (book). In our study, we find a negative correlation between the interest in the selected movie (book) and the utility of unlicensed usage ($r = -.150$, $p < .001$) and books ($r = -.100$, $p < .001$). Thus, the more interested the consumer is in one specific title, the less likely that he or she will consider unlicensed usage.⁷ Assuming that interest in the titles is lower when consumers merely want to be entertained and have more alternatives to choose from, consumers would be more difficult to convert to paying customers by optimizing pricing or timing.

In total, we believe that an overestimation of unlicensed usage is more likely in our study. However, the primary focus of our study is not to estimate how many consumers use unlicensed media products but rather to estimate how sensitive these consumers are to alternative market offerings. In this regard, it seems plausible (although not necessary) that an overestimation of unlicensed usage will be better suited to highlight the impact of pricing and timing decisions, i.e., an underestimation would make the results seem less sensitive. Because we find only limited impact of the marketing actions to reduce unlicensed usage we can conclude that the true benefit of optimizing pricing and timing would be even less, which is in line with our overall conclusion.

Our study is also limited by the fact that we only studied timing and pricing variations within a reasonable range, which we found to be ineffective for fighting unlicensed usage. Nevertheless, it can be assumed that more drastic changes to the marketing mix will have a greater effect on unlicensed usage, e.g., providing an on-demand ad-based product for free ([Papies et al., 2011](#)). Relatedly, we cannot provide insight into the effects of unlicensed usage in the case of subscription-based business models that apply flat rates or that bundle products.

Further, we intentionally did not provide specific information about the characteristics of the unlicensed alternatives but left it to the consumers' imagination because their access to unlicensed channels and perceived risk and cost can be distributed heterogeneously across the sample. However, because our illegal channel remains latent, we cannot account for the (quality of the) unlicensed media type or its timing. The latter is an important determinant for the attractiveness of unlicensed media and potential problem that can lead to piracy, e.g., in an international context, where media products are sequentially released in specific nations first.

Finally, we study overall revenue effects in order to optimize total sales across all channels for the total market. However, we note that we do not capture all potential revenue sources (e.g., merchandising). We also do not model the possibility of price differentiation within a channel across time, which would lead to an additional revenue stream. Although movie theater prices largely remain constant and, in Germany, the book market requires fixed prices, DVD or Blu-Ray prices could be reduced across time, e.g., to counter low demand. Taken together, these limitations are fruitful areas for future research.

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⁷ We also collected data on the number of purchases/rentals per media type. For movies, we asked for the total number of movies the respondents have watched in theaters, which is negatively correlated with the preference for unlicensed usage ($r = -.035$, $p = .078$). The preference for unlicensed usage is also negatively correlated with the purchase frequency of hardcover books ($r = -.075$, $p = .002$) and paperback books ($r = -.056$, $p = .024$) but not with the frequency of book rentals ($r = .040$, $p = .104$) or e-book purchases ($r = -.013$, $p = .607$). This result offers face validity for our results since consumers who are more inclined (and willing) to purchase are less prone to engage in unlicensed usage.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <http://dx.doi.org/10.1016/j.ijresmar.2015.06.005>.

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