



No such thing as a free movie? Cross-country evidence on the potential impact of AVOD streaming services

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Abstract

This study investigates potential disruption from advertising-based video-on-demand (AVOD) streaming for new-release in-home films. Using stated-preference discrete choice experiments on representative samples from four major countries, we model demand and examine substitution patterns between AVOD and the incumbent transactional video-on-demand (TVOD) model. In addition, we consider illegal streaming alternatives, including the possibility of using a VPN to provide anonymity of the unlawful activity. We find strong preferences for AVOD across each country sample, with large cross-price substitution patterns away from TVOD. An entry simulation exercise provides back-of-the-envelope estimates for ad pricing required to offset reduced revenues if AVOD were offered alongside TVOD for new-release in-home films.

Keywords Video on demand · Digital distribution · Movie industry · Stated preference · Online piracy

1 Introduction

In-home entertainment revenues have become increasingly important for film distributors in recent decades. While DVD and BluRay were important formats from the late 1990 s through to the early 2010 s, these have now given way to video-on-demand (VOD).¹ Popular subscription-based video-on-demand (SVOD) services, such as Netflix, have gained huge popularity for new-release television and older film catalogue content. However, most *new-release* in-home films are not released

¹ In Europe, for example, revenues from VOD increased from €388.8 million in 2010 to €11.6 billion in 2020. See <http://rm.coe.int/trends-in-the-vod-market-in-eu28-final-version/1680a1511a>.

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directly to SVOD platforms.² Instead, the typical first window for new-release in-home films is transactional video on demand (TVOD), where the consumer essentially rents the film for a short time period, such as 24 or 48 h, via a cable or online service.³ This model obviously replicates the traditional hiring of the physical media from video rental stores that was synonymous with the older formats such as Beta, VHS, DVD, and BluRay.

While TVOD continues to be the first and most important window of release for in-home films, an alternative model has the *potential* to disrupt the traditional sequence of release. Advertising-based video-on-demand (AVOD) services have increased dramatically in recent years and provide consumers with free content paid for by advertising revenues. Led by the success of services such as Peacock (NBCUniversal), Tubi (Fox), and Pluto TV (ViacomCBS), AVOD has emerged as a genuine competitor to incumbent SVOD providers.⁴ For budget-conscious consumers willing to accept advertisement interruptions, AVOD services provide an attractive alternative. Although most film content on current AVOD services would be considered as older catalogue (i.e. not new-release films, as are the focus this study), services such as Crackle Plus, The Roku Channel and Tubi have all recently invested in original film content.⁵ In an increasingly competitive marketplace, film distributors are beginning to consider AVOD as a complement to TVOD for new-release films.

While AVOD provides one potential substitute platform, it is not the only available alternative to TVOD. In recent years, illegal streaming services that mimic legitimate platforms have been increasing in sophistication. With the growing number of legal providers of entertainment content, there is evidence illegal consumption (or simply, piracy) has been increasing again, after initial declines following the entry and uptake of early SVOD services.⁶ While content providers still attempt to prevent illegal consumption using fines and other legal deterrents, their efforts are made increasingly difficult by technology designed to conceal the behaviour, such as virtual private networks (VPNs). While the use of VPNs themselves is not typically illegal, they do allow consumers to access unlawful content with almost zero probability of being detected by content owners. As a result, competition from illegal providers continues to be of major concern for film distributors.

Ideally, to model demand and substitution patterns between AVOD, TVOD, and illegal alternatives, industry data would be merged with contemporaneous data capturing illegal consumption activity. However, for at least three reasons this is infeasible. First, at the present time, the vast majority of new-release

² Throughout this study, 'new-release' film refers to a new *in-home* film that may either be post-theatrical release, or simply a new in-home release that did not have a theatrical release.

³ Notable recent exceptions released directly to SVOD include: *Spenser Confidential* (Netflix), *Hamilton* (Disney+), *Roald Dahl's The Witches* (HBO Max) and *Borat Subsequent Moviefilm* (Amazon Prime Video).

⁴ In its annual audience insights report, Tubi (2022) suggests that AVOD viewership is poised to overtake SVOD in 2022. AVOD revenues are set to reach \$31.4 billion by 2026, nearly triple 2021 levels.

⁵ See <https://nscreenmedia.com/avod-originals-crackle-plus-the-roku-channel-tubi/>.

⁶ In 2021, Interpol labelled digital piracy one of the fastest growing crime areas, pointing to increases of over 60 percent in some countries during the past 12 months. See <https://www.interpol.int/en/Crimes/Illicit-goods/Project-I-SOP>.

in-home films are *not* released simultaneously on both and TVOD and AVOD services, which implies industry data is likely to be sparse, if at all available. Second, even where industry data exists, it is typically commercially private and unavailable to researchers. Third, accurate information on illegal consumption is also problematic to observe. This is particularly complicated by the fact that many who partake in the activity use VPNs or other methods to conceal the activity.

For these reasons, our empirical analyses use data generated from stated-preference discrete choice experiments (DCEs). While DCEs are well known to be susceptible to hypothetical bias, their advantage lies in being able to control the experimental design to create data perfectly suited to the underlying research question. We frame the DCE choice tasks over four alternative ways to watch a new-release film at home: (1) TVOD, (2) AVOD, (3) illegal streaming, and (4) illegal streaming with anonymity (via a VPN). Related to each alternative, is one specific product attribute: (1) price (TVOD), (2) advertising-breaks (AVOD), (3) punishment probability (illegal streaming), and (4) VPN price (illegal streaming with anonymity). To address issues of external validity that may exist within one sample, we conduct four separate analyses on samples of participants from the USA, UK, Germany and France. Beyond being the most important markets in the developed world, these countries differ markedly with respect to institutional contexts relevant to both legal and illegal consumption.

Simply stated, our primary research question asks how AVOD can *potentially* substitute TVOD for in-home consumption of new-release films? (Noting use of the term ‘potential’ to emphasise such a trade-off is not typical for most new-release films at the present time). In addition, we are also interested in how AVOD potentially substitutes illegal consumption for the same new-release films. In order to answer these questions, we build a rich mixed logit demand model, which provides the foundation for analyses of the relevant substitution patterns. We examine elasticities and predictive margins for the four alternatives with respect to the attributes we define related to each of these alternatives. We also undertake a simulation exercise to examine how the potential entry of AVOD could disrupt the existing model (without AVOD), which allows us to provide back-of-the envelope estimates of ad pricing necessary to accommodate the implied reduction in TVOD revenues.

Our results reveal a number of important findings. First and foremost, AVOD is the most popular alternative in each country sample, accounting for more than 50% of selections across the four samples combined. However, the preference for AVOD appears strongest in UK, Germany and France. Second, there is strong substitution towards AVOD from TVOD price increases in all country samples, relative to the illegal and no-choice alternatives. Third, there is limited evidence that advertising-break times (measured in total minutes) impact preferences, which suggests consumers are generally willing to tolerate disruption for free content. Fourth, there is limited evidence increased punishment which causes a substitution towards legal alternatives and is more likely to cause substitution towards (anonymous) illegal streaming using a VPN. Fifth, increased VPN price causes substitution towards both the other illegal alternative (without anonymity) as well as the legal alternatives.

Finally, beyond the substitution analyses and simulation exercise based on the DCE results, we use information collected from two incentive-based behavioural experiments, responses to survey questions regarding illegal consumption, and demographic information to provide additional insight into the selections made by participants in the DCE. Specifically, we investigate whether any of these additional variables had a systematic relation with the number of times an individual selected a particular alternative across the 12 choice tasks completed. While we find no evidence that the time and risk preferences elicited from the behavioural experiments impact alternative selection, we do find actual illegal consumption experience relevant for selecting either of the illegal alternatives in the DCE.

The remainder of this paper is structured as follows. Section 2 reviews the related literature. Section 3 outlines the data and empirical methods. The results of the experiment are presented and discussed in Sect. 4. Finally, Sect. 5 offers concluding remarks.

2 Literature

This study builds on existing literature investigating waves of technological disruption in the market for in-home entertainment.⁷ Early work examines competition between network and cable television services (Park, 1971; Ellickson, 1979); the arrival of direct broadcast satellite services (Goolsbee & Petrin, 2004); and elasticities between in-home film purchases and rentals (Mukherjee & Kadiyali, 2011). The advent of online streaming services led to the examination of cord-cutting behaviour, the cancellation of satellite and cable television services in favour of emerging online platforms. Prince and Greenstein (2017) use a simple model of choice to find that the introduction of online streaming services leads to an increase in cord-cutting among younger and low-income households.

Axarlian (2017) examines a studio-led initiative to develop a standardised ecosystem to manage and store digital film libraries. The author exploits variations in the timing of a flexible digital video “cloud locker” and suggests that its establishment leads to an increase in in-home film purchases and a decrease in rentals. The availability of online in-home entertainment has also been found to increase demand for “niche” titles relative to “blockbusters” (Zentner et al., 2013).

The arrival of SVOD services has been studied from both the demand and supply sides. Glasgow and Butler (2017) use a stated-preference DCE to show that willingness to pay (WTP) for such services is positively influenced by the speed of content availability and content catalogue size. The sharing of personal information is found to negatively affect WTP. McKenzie et al. (2019) also use a DCE to examine how SVOD services disrupt film and television consumption. The authors find that consumers derive significant utility and large surpluses from SVOD services when compared to legal and illegal incumbent services. Kim et al. (2017) suggest that WTP

⁷ McKenzie (2012, 2023) provides in depth documentation regarding the evolution of the literature examining the economics of movies over recent decades.

is primarily driven by the recommendation system, resolution and viewing options offered by VOD services.

Schauerte et al. (2021) build upon resource-based theory to develop a conceptual framework that identifies strategic diversification options for television companies to adopt in the face of increasing levels of digitisation. The authors highlight unique potential synergies between traditional linear television providers and VOD services. Hiller (2017) examines Netflix's catalogue to determine the characteristics that drive strategic bundling strategy among SVOD services. Results suggest that titles of median commercial success are among the most frequently bundled and streaming services take into account the number of related titles already on offer. Kim et al. (2021) investigate consumer preferences for bundled pay-TV and VOD services in Korea. Bundling is not found to be an effective way to increase the market share of pay-TV service providers, with Korean viewers preferring domestic content broadcast on terrestrial TV channels.

Prior studies concerning digital piracy's effect on the legal consumption of filmed entertainment are also of relevance.⁸ To date, there is mixed evidence with regard to the displacement effect of illegally downloaded or streamed content. In early research on the topic, studies such as Oberholzer-Gee and Strumpf (2007) and Smith and Telang (2009) suggest that the availability of pirated content does not cannibalise legitimate sales. This was in contrast to an earlier examination of music file sharing by Zentner (2006) who suggests that peer-to-peer usage decreases the probability of buying music by 30 percent.

Subsequent research by Danaher and Smith (2014) exploited cross-country variation in the shutdown of *Megaupload* (a major digital piracy site) and found evidence that illegal file sharing does displace digital movie sales. However, Peukert et al. (2017) suggest that such findings are dependant upon the breadth of a film's release. They find that after the shutdown of *Megaupload* the revenue of films that open on a relatively small number of screens decreases. Cwiakowski et al. (2016) report that willingness to pay for pirated content is reduced when the proceeds from legal sales are transferred to a good cause.

Godinho de Matos et al. (2018) find that providing households that have a prior history of digital piracy with a legal SVOD package decreases both the downloading and uploading of illegal content. From a title level perspective, Hardy (2022) employs a difference-in-difference approach to analyse how an unauthorised pre-release leak of *Game of Thrones* affected viewership, finding that a leak of the first four episodes of the show's fifth season led to an increase in the piracy of subsequent episodes. The leak was also found to negatively impact the viewership of shows that shared an audience with *Game of Thrones*.

The efficacy of anti-piracy legislation has also been scrutinised. In the case of box-office revenue, Orme (2014) examines the effectiveness of six major US anti-piracy policies. The author finds that, with one exception, these policies have either been ineffective or counter-productive from the perspective of the film studios. A similar lack of efficacy was found in international markets (McKenzie 2017). McKenzie et al. (2019) also find mixed evidence regarding the effectiveness of

⁸ See a recent survey provided by McKenzie (2020).

anti-piracy policy in the case of in-home entertainment. An increase in fines and punishment probabilities is only found to yield a relatively small marginal effect on illegal consumption.

Previous studies have investigated advertising in a range of in-home entertainment contexts. One commonly addressed topic relates to switching behaviour during advertising breaks (Van Meurs, 1998; Song et al., 2021). Wilbur (2016) suggests that film advertising is avoided less frequently than other advertising categories, such as websites. Deng and Mela (2018) note that digital set-top boxes enable advertisers to target households, a practice labelled “microtargeting”. The authors utilise household level viewing data to show that device-level targeting can be more effective than existing show-level targeting. Overall, microtargeting is found to lower costs and increase advertiser profit.

Furini (2023) shows that personalised overlay advertising was less likely to be avoided than generic overlay advertising, providing a promising path for encouraging viewer-commercial interactions on AVOD platforms. Jeong et al. (2011) find both advert length and frequency are positively associated with advertising effectiveness. However, Varan et al. (2020) suggest that there are diminishing returns to advertising length. They find half of the unaided brand recall of a 30-s advertisement stems from the first five seconds of exposure.

Belo et al. (2019) studies the impact of time-shifting (cloud recordings of programming that can be viewed after the original broadcast) on television consumption and advertising viewership. The authors find that overall television consumption increased in households that were given access to a time-shifting entertainment bundle. However, there was no evidence to suggest that households used time-shifting to strategically watch fewer advertisements. In contrast, Glasgow and Butler (2017) find that viewers are, on average, willing to pay a premium to avoid advertising when choosing an SVOD service. Finally, Frade et al. (2021) present a comprehensive review of the existing literature covering a wider definition of streaming video advertising than the one used in this study, incorporating a range of online advertising on platforms such as YouTube.

3 Data and empirical methods

The primary objective of our empirical exercise is to explore how the existence of advertising-based video-on-demand (AVOD) streaming services potentially substitutes demand on both legal transactional video-on-demand (TVOD) and illegal streaming services. Given the lack of revealed-preference data necessary for such an exercise, we develop a stated-preference discrete choice experiment (DCE) to generate the underlying data for our analyses. In addition to the DCE, we undertake two incentive-based behavioural experiments to elicit information about individuals’ time and risk preferences. Finally, we also perform a survey with questions about illegal consumption attitudes and experience with such activity, alongside questions capturing general demographic information. The participants in the experiment were recruited from four countries: USA, UK, Germany, and France. These countries were selected for two main reasons. First, they represent the most important

major markets in the developed world. Second, there exist different cultural and institutional factors between the countries that may illuminate different results and insights.

3.1 Sample and data collection

Four separate online experiments were conducted between June 2020 and March 2021 using samples of participants based in the USA, UK, Germany and France.⁹ Participants were recruited by a leading multinational market research company. Each of the four experiments was localised in terms of language, market context, and currency. The experiments were open to residents of each country aged 18 and over who reported enjoying watching films at home.¹⁰ The samples were collected to be representative of the wider population of each country in terms of age and gender (Table 1).

Prior to undertaking the experiment, consent and instruction information were provided to participants. Instructions were also available as a pop-up window during the experiment. The experiment was split into three stages. In the first stage, participants were paid a base rate of US\$5 (or equivalent local currency) for the completion of 12 choice tasks, which are described in more detail below. In the second stage, participants completed survey questions related to attitudes and experiences with piracy. Demographic information was also captured at this stage. In the third stage, participants had the opportunity to earn incentive-based payments (ranging from US\$0 to US\$4) for the completion of two separate behavioural experiments designed to separately elicit time- and risk-preference information. Further details about the survey questions and behavioural experiments are provided in the Online Appendix to this paper.

After checking for quality using both attention and timing filters, a total of 812 participants completed both stages of the experiment (211 in the USA, 201 in the UK, and 200 each in Germany and France). This resulted in a total of 9744 observations across the four countries. The number of participants in each country sufficiently exceeds the largest S -estimate for each individual model parameter. In our experiments, the largest S -estimate was 53, which is significantly below our lowest sample size of 200 (Germany and France).¹¹

⁹ We note this period coincided with COVID and potential lockdowns across countries, which may potentially have affected some participants' responses. While we can't entirely rule out such impact on our results, we highlight the fact the choices related to 'in-home' entertainment and the price of consumption (in particular, related to TVOD) is relatively low. We also note a relatively low proportion of participants in the lowest incomes earning buckets, ranging between 9% (USA) and 13% (Germany). However, despite the potential for reduced incomes impacting demand, we also note that many out-of-home expenses were reduced during this period, so it is not *a-priori* clear where any bias might exist.

¹⁰ This necessarily assumes they had access to a TV (or other device) at home and a high-speed internet connection. Given the samples all relate to countries with high levels of TV ownership and broadband internet penetration, we believe these assumptions are reasonable.

¹¹ The S -estimate is derived from the estimated prior parameters and standard errors. It represents the minimum sample size required to obtain a statistically significant estimate of each individual parameter at 95% confidence (Rose & Bliemer, 2013).

Table 1 Sample representativeness

	US		UK		Germany		France	
	Sample (%)	Pop (%)	Sample (%)	Pop (%)	Sample (%)	Pop (%)	Sample (%)	Pop (%)
<i>Age</i>								
18–34	29.9	29.8	27.9	27.8	24.5	24.2	25.0	25.1
35–54	32.7	32.3	33.3	33.2	32.0	31.9	33.0	32.7
55+	37.4	37.9	38.8	39.0	43.5	43.9	42.0	42.2
<i>Gender</i>								
Female	51.2	51.3	50.7	50.6	50.0	50.7	51.5	51.7
Male	48.8	48.7	49.3	49.4	50.0	49.3	48.5	48.3

Population data sources: United States Census Bureau (National Population by Characteristics: 2019), United Kingdom Office for National Statistics (Estimates of the Population: 2020), Federal Statistical Office of Germany (Microcensus: 2020), French National Institute of Statistics and Economic Studies (Demographic Balance Sheet: 2019)

3.2 DCE development

To elicit the preferences necessary to make inferences concerning the potential impact of AVOD, we create hypothetical viewing experiences that require participants to choose between viewing alternatives for a new-release film at home.¹² We consider four alternative viewing platforms: (1) transactional video on demand (TVOD), (2) advertising video on demand (AVOD), (3) illegal streaming without anonymity (IS), and (4) illegal streaming with anonymity via a VPN (ISANON). Participants were also given the option to opt out via a no choice alternative if none of the other alternatives appealed to them. Table 2 details the alternatives used in the choice experiment, along with definitions and sample platforms.

Attributes were selected to elicit preferences for the different viewing alternatives, as opposed to the film attributes. The set of attributes include: (1) price of the film (PRICE), which is for a 48-hour rental in local currency; (2) length of total advertising breaks during viewing (ADVERT), which occur over 10 breaks of equal length (e.g. total of 30 min would be 10×3 min breaks); (3) copyright infringement detection probability (PUNISH), where punishment applies the relevant laws of each respective country¹³; and 4) and the price of a VPN service (VPNPRICE), which is intended to approximate an average monthly VPN service charge (\$12 in the US) divided by (unlawful) consumption of eight films per month. In defining these attributes, we focus on the relevant platform-specific factors that drive viewing decisions.

¹² Specifically, participants were instructed that they were choosing between alternatives to watch a new-release film that they had not seen before on the main television in their home. They were also told all alternatives were in HD quality and they were expecting to enjoy the film.

¹³ As discussed in further detail below, we also asked survey questions to gauge what punishment people expected (see Online Appendix Table A.1). We note the most common perception was modest fine (between US\$125 and US\$1250). We also note between 13% (UK) and 24% (France) didn't know what form punishment would take.

Table 2 Alternatives and attributes

Alternative	Abbrev	Definition
<i>a. Alternatives</i>		
Transactional video on demand	TVOD	HD film from online rental service (e.g. Apple iTunes, Google Play)
Advertising-based video on demand	AVOD	HD film from online ad-supported service (e.g. NBC.com, BBC iPlayer)
Illegal streaming	IS	HD film from illegal streaming service (e.g. 123 Movies, Popcorn Time)
Illegal streaming—with anonymity	ISANON	HD film from illegal streaming service (via VPN) (e.g. 123 Movies, Popcorn Time)
No choice	NONE	
<i>b. Attributes</i>		
Price per film (local currency)	PRICE	1.99, 3.49, 4.99, 6.49, 7.99 (US) 1.49, 2.49, 3.49, 4.49, 5.49 (UK) 1.75, 3.00, 4.50, 5.75, 7.00 (Germany/France)
Advertising breaks (total minutes)	ADVERT	20, 25, 30, 35, 40 (all countries)
Punishment probability (percent)	PUNISH	10, 30, 50, 70, 90 (all countries)
Price of VPN (local currency)	VPNPRICE	0.50, 1.00, 1.50, 2.00, 2.50 (US) 0.50, 0.75, 1.00, 1.25, 1.50 (UK) 0.50, 1.00, 1.50, 2.00, 2.50 (Germany/France)

While other attributes could have been included, it is important to avoid cognitively overburdening participants by presenting choice tasks that are too complex.¹⁴

Each attribute relates to one specific alternative. The levels of each attribute (displayed in Table 2) are varied across each of the 12 choice tasks for the alternative in question and take a value of zero for the remaining alternatives. For example, the total amount of advertising shown during a film ranges from 20 to 40 min for the AVOD platform and zero for all other platforms. Similarly, the price of the film is only non-zero in the case of TVOD, where it ranges from US\$1.99 to US\$7.99 (or the local currency equivalent).¹⁵ The attribute ranges were based on industry norms during 2020 in the USA, where the typical rental price was US\$4.99 and each hour of broadcast viewing included approximately 15 min of advertising (i.e. 30 min of advertising for a 90-min film during a two-hour time slot).¹⁶ Example choice tasks provided to US and German participants are shown in Online Appendix Fig. A.1.

¹⁴ By design, the utility (or disutility) generated by other streaming platform-specific attributes will be captured by the alternative-specific constant shown in Eq. 1 and discussed further below.

¹⁵ This approach also helps reduce the possibility of inter-attribute correlations that may bias results. As choices are driven by attribute-specific levels, the possibility of presenting participants with confusing combinations of attribute levels is minimised.

¹⁶ We note there are exceptions outside the chosen attribute ranges. For example, with respect to pricing, some films are simultaneously released ‘day and date’ in cinemas and on TVOD services, whereas other films bypassed theatrical release during COVID. Such films are often priced in the order of US\$19.99 for

The specific combinations of attributes and levels that individuals evaluate in the choice sets is governed by an experimental design. The goal of such designs is to present choice tasks to participants in the most efficient manner (i.e. to generate parameter estimates with the smallest possible standard errors). In order to achieve this, we adopt a D -efficient experimental design (Rose & Bliemer, 2008). Priors used for the estimation of the D -efficient experimental design were obtained using a pilot experiment with 20 participants.

3.3 Choice modelling

Stated-preference DCEs are underpinned by random utility theory, where an individual's utility is derived from the attributes of all alternatives under consideration, subject to an unobserved error term. We can express individual i 's utility from viewing a film on streaming platform j as

$$U_{ij} = \alpha_{ij} + \beta'X_j + \varepsilon_{ij}, \quad (1)$$

where α_{ij} is individual i 's alternative-specific constant for streaming platform j , β' is the parameter vector associated with the vector of viewing attributes X_j , and ε_{ij} is a random error term that captures unobservable contributions to utility. To operationalise Eq. 1, we make specific assumptions about the parameters and the error term. In particular, we model α_{ij} as linear function of observable individual demographic variables and a random term, such that $\alpha_{ij} = \alpha_j + \gamma D_i + \eta z_i$, where D_i is a vector of demographics for individual i , γ is the parameter vector associated with each demographic characteristic $d \in D$, and z_i is a random draw from an underlying (multivariate) distribution. By modelling the alternative specific constants in this way, the model overcomes the well-known independence from irrelevant alternatives (IIA) restriction and permits estimates of substitution patterns. Finally, we assume the error term is extreme value type 1 (EV1) distribution. Together these assumptions imply the (expected) probability of individual i selecting platform j can be defined as

$$E[P_{ij}|\alpha_i] = \int_{\alpha_i} \frac{\exp(\alpha_{ij} + \beta'X_j)}{\sum_{k=1}^K \exp(\alpha_{ik} + \beta'X_k)} f(\alpha_i) d\alpha_i. \quad (2)$$

The choice probabilities are the standard logit probabilities integrated over the density $f(\alpha_i)$. Because there is no closed form solution to the integral in Eq. 2, parameters are estimated by maximum simulated likelihood as described by Cameron and Trivedi (2005). This choice model goes by different names, including the random-coefficients logit model, mixed multinomial logit, or simply mixed logit. We follow convention in the DCE literature and refer to it as the mixed logit.

Footnote 16 (continued)

a 48-hour rental. Similarly, with regard to advertising, some of the new AVOD services have considerably lower ad times during a typical 90-minute film. Our intention with selected ranges was to align both price and ad breaks to those most familiar to the majority of people in order to be most realistic.

3.4 Elasticities, predictive margins, and entry simulation

The mixed logit model described in Eq. 2 allows us to examine relationships between the alternatives and attributes in terms of the underlying utility function. However, by itself it is unable to provide direct insights concerning the substitution patterns that permit inference concerning the impact of AVOD on the other alternatives. For such analyses, we use the parameters of the model to compute elasticities and predictive margins. We also undertake a market entry simulation by using the model to generate counterfactual choice probabilities assuming the AVOD alternative was not available.

We compute both own- and cross-attribute elasticities for each alternative, as well as the outside option. Observation specific own-attribute elasticities are computed as

$$\epsilon_{x_{jk}}^{P_j} = \frac{x_{jk}}{P_j} \int_{\alpha_i} \frac{dU_{ij}}{dx_{jk}} P_{ij} (1 - P_{ij}) f(\alpha_i) d\alpha_i \tag{3}$$

and cross-attribute elasticities are computed as

$$\epsilon_{x_{j'k}}^{P_j} = \frac{x_{j'k}}{P_j} \int_{\alpha_i} \frac{dU_{ij}}{dx_{jk}} P_{ij} P_{ij'} f(\alpha_i) d\alpha_i, \tag{4}$$

where P_{ij} is the probability individual i chooses alternative j . Given the nonlinear nature of the mixed logit model, we follow Louviere et al. (2000) and calculate probability-weighted sample enumerated elasticities as

$$\bar{\epsilon}_{x_{jk}}^{\bar{P}_j} = \left(\sum_{i=1}^N \hat{P}_{ij} \epsilon_{x_{jk}}^{P_{ij}} \right) / \sum_{i=1}^N \hat{P}_{ij} \tag{5}$$

where \hat{P}_{ij} is an estimated choice probability and \bar{P}_j refers to the aggregate probability of choice of alternative j

While elasticities provide some insight into substitution patterns, they do not directly inform about the probabilities certain alternatives will be selected as attribute levels are varied. For this exercise, we analyse the aggregate predicted probabilities of each alternative across the levels of each attribute. These predicted marginal probabilities can also be computed beyond the support range of the levels presented to participants, which allows additional inference.

Another way in which we can examine the substitution patterns between the alternatives is to simulate the entry of AVOD. We do this by estimating the full model then removing the AVOD alternative from the choice set and recalculating aggregate choice probabilities. Because the IIA assumption is relaxed in the mixed logit model, participants who previously selected AVOD substitute towards the remaining alternatives in a manner consistent with their individual-specific preferences. The resulting displacement patterns provide additional insights regarding how the entry of AVOD has disrupted the incumbent providers.

3.5 ZOIB models of choice selection

Finally, alongside the DCE data collection and analysis, we also collect experimental and survey evidence related to behavioural time/risk preferences; illegal consumption attitudes, experiences, and beliefs; and demographic variables. To investigate whether any of these impact choice outcomes, we examine four separate zero–one-inflated-beta (ZOIB) models for each of the four country samples. The ZOIB model is particularly appealing as it applies a mixture approach to modelling zero choice (logit model), proportion of selections (beta model), and one choice (logit model). For each model piece, the grouping is essentially whether a participant *never*, *sometimes*, or *always* selects a particular alternative across the 12 DCE choice tasks, respectively.¹⁷ Examining how the behavioural- and survey-based variables described above influence alternative selection provides additional information related to our core research questions, but avoids excessively complicating the mixed logit model that underpins our main analyses.¹⁸

4 Results and discussion

4.1 Preliminary descriptive evidence

Before we discuss the main empirical results, we provide descriptive evidence about the choices selected by participants in the four DCEs in Table 3. Overall, we observe the legal options (TVOD and AVOD) are strongly preferred over the illegal alternatives (IS and ISANON). In the UK, Germany and France, AVOD is clearly the most preferred alternative, accounting for over half of the selections in each country sample.¹⁹ In the USA, the share AVOD and TVOD selections is comparable (36.9% and 35.4%, respectively), providing some evidence AVOD is not as favoured in this country sample. US participants were the most willing to select either of the illegal alternatives, where over 20% of choices were for either IS or ISANON. In contrast, German participants were the least willing to select either illegal alternative. The use of a VPN to provide anonymity (ISANON) is more popular than the illegal alternative without anonymity (IS) in all countries.

Figure 1 illustrates the combined frequency of selections across alternatives for all countries. There is evidence of platform loyalty for AVOD, with over 25% of participants exclusively selecting this alternative. Over 40% of participants never selected the TVOD alternative. Among those who did select TVOD at least once,

¹⁷ Figure 1 show for all alternatives, a number of participants *never* selected an alternative, and for AVOD a number *always* selected this alternative.

¹⁸ We examined a range of latent class and alternate mixed logit models incorporating behavioural parameters but none were found to provide informative evidence. As we describe above, our preferred mixed logit models incorporate demographic variables interacted with the alternative specific constants.

¹⁹ We note at the outset we have not allowed for the possibility of people using ad blockers in any respect. However, in the context of watching one of the broadcaster-based AVOD services via the ‘main television in the home’, we note this is technically challenging and likely beyond the capability of the average viewer.

Table 3 Share of selections

Alternative	Times Presented	Share of selections				
		All (%)	US (%)	UK (%)	Germany (%)	France (%)
TVOD	9744	25.0	35.4	25.0	18.3	20.9
AVOD	9744	52.0	36.9	55.3	64.2	52.5
IS	9744	5.1	7.6	4.3	2.3	5.9
ISANON	9744	10.7	14.2	10.7	6.7	10.8
NONE	9744	7.2	5.9	4.7	8.5	9.9

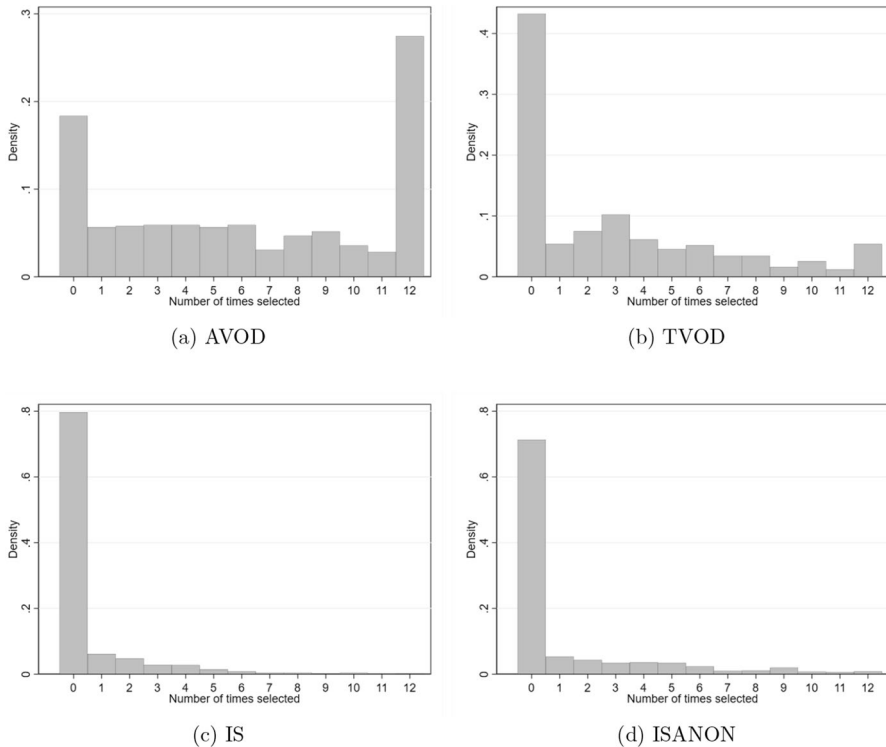


Fig. 1 Selection histograms

the number of selections is more uniformly distributed. The distributions relating to the illegal alternatives are heavily skewed. Approximately 80% of participants did not select the IS alternative in any choice tasks, while over 70% also avoided ISANON. Very few participants were loyal only to illegal alternatives, providing some evidence it may be possible to curb illegal consumption by offering legal alternatives that are attractive to viewers.

4.2 Mixed logit results

We present the results of the mixed logit model in Table 4. Separate models are estimated for each of the four countries. In all cases, the coefficients relating to (TVOD) price and (ISANON) VPN price are negative and statistically significant at the 1% level, confirming price increases reduce utility. Increases in the punishment probability related to the IS alternative also decrease utility (again, significant at the 1% level) in three of the four country samples. The only exception is the German sample, where this attribute is not statistically significant. This is potentially related to

Table 4 Mixed logit results

	US		UK		Germany		France	
	Coef	S.E	Coef	S.E	Coef	S.E	Coef	S.E
<i>Alternatives</i>								
TVOD	5.270***	(0.879)	5.460***	(0.908)	6.378***	(1.145)	7.149***	(1.310)
AGE	-0.056	(0.214)	-0.513**	(0.211)	-1.042***	(0.222)	-0.700**	(0.333)
INCOME	0.097	(0.200)	0.627**	(0.286)	0.697**	(0.271)	0.443	(0.332)
GENDER	1.575**	(0.689)	0.668	(0.876)	-0.039	(0.750)	-1.041	(1.015)
AVOD	2.248**	(0.890)	5.925***	(1.079)	3.922***	(1.092)	6.179***	(1.298)
AGE	0.360*	(0.218)	0.070	(0.247)	-0.179	(0.200)	-0.099	(0.250)
INCOME	0.256	(0.194)	-0.006	(0.315)	0.639**	(0.271)	-0.186	(0.406)
GENDER	0.645	(0.696)	0.577	(1.042)	0.969	(0.669)	0.142	(0.824)
IS	1.237	(0.978)	1.310	(0.998)	-0.560	(1.391)	5.297***	(1.116)
AGE	-0.266	(0.238)	-1.375***	(0.287)	-1.034***	(0.259)	-1.212***	(0.271)
INCOME	0.099	(0.239)	0.618*	(0.358)	0.265	(0.298)	-0.114	(0.305)
GENDER	2.233***	(0.821)	-0.065	(0.930)	2.184**	(0.913)	-0.681	(0.861)
ISANON	1.795**	(0.899)	1.531	(0.958)	1.767	(1.197)	6.025***	(1.294)
AGE	-0.016	(0.243)	-1.056***	(0.230)	-1.321***	(0.229)	-1.619***	(0.343)
INCOME	0.031	(0.206)	0.546*	(0.318)	0.476*	(0.284)	-0.121	(0.322)
GENDER	2.103***	(0.788)	0.507	(0.898)	1.783**	(0.759)	-0.394	(0.897)
<i>Attributes</i>								
PRICE	-0.374***	(0.029)	-0.705***	(0.059)	-0.984***	(0.066)	-0.553***	(0.048)
ADVERT	0.009	(0.008)	-0.034***	(0.010)	-0.005	(0.010)	0.008	(0.010)
PUNISH	-0.010***	(0.003)	-0.033***	(0.006)	-0.009	(0.007)	-0.017***	(0.004)
VPNPRICE	-0.707***	(0.115)	-0.914***	(0.278)	-1.136***	(0.184)	-0.447***	(0.143)
<i>Rand. Param.</i>								
TVOD(N)	3.040***	(0.338)	3.706***	(0.519)	4.459***	(0.431)	5.487***	(0.537)
AVOD(N)	3.376***	(0.266)	5.044***	(0.492)	4.334***	(0.390)	6.449***	(0.661)
IS(N)	3.852***	(0.382)	4.263***	(0.546)	5.222***	(0.453)	5.280***	(0.639)
ISANON(N)	4.370***	(0.396)	4.257***	(0.490)	5.129***	(0.493)	6.147***	(0.597)
Log likelihood	-2315.65		-1596.83		-1420.73		-1639.58	
Obs	2532		2412		2400		2400	

“N” denotes normal distribution of random parameter; standard errors in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

the low tendency of German participants to select this alternative (see Table 3), coupled with strict existing policy responses when it comes to content piracy.

Increases in advertising level (AVOD) only negatively affects utility in the UK sample. We speculate this may be driven by the fact that ad-supported content is now the norm across many different types of digital platforms (newspapers, social media, etc.), which implies higher overall tolerance of advertising in the consumption of digital media. Estimated alternative-specific constants reveal both AVOD and TVOD provide statistically significant increases in utility, to at least the 5%

level in all countries, relative to the outside option. In the US and German samples, TVOD yields relatively higher utility compared with AVOD (approximately 2.3 and 1.6 times higher, respectively). In the UK and French samples, the utility derived from the two legal alternatives is much closer in magnitude. Relative to the outside option, IS is only found to yield a statistically significant increase in utility in the French sample, while ISANON leads to increased utility in both the US and French samples.

With regards to the socio-demographic variables, there is some evidence that younger participants derive higher utility from TVOD and both illegal alternatives. This is particularly evident in the UK, German and French samples. Higher income positively affects TVOD and ISANON selection in both the UK and German samples, while higher-income participants derive greater utility from AVOD in Germany and IS in the UK. Gender effects appear only in the US and German samples, with males deriving relatively higher utility from both illegal alternatives. In the US sample, males derive higher utility from TVOD.

Finally, all random parameters on the alternative-specific constants are statistically significant across each of the four models relating to each country sample. This implies participants are heterogeneous in their preferences and provides reassurance the mixed logit model is appropriate. For our purposes, it also provides confidence that the substitution patterns we investigate are more accurate as they are not restricted by the IIA property.

4.3 Elasticities

While the results in Table 4 reveal broad evidence about the preference of participants, they are not directly comparable across countries and provide no information concerning the substitution patterns of primary interest. As the first step to examining such substitution patterns, Table 5 reports probability-weighted elasticities for each attribute across the four countries, which *are* directly comparable across countries.

With respect to (TVOD) price, German participants are relatively more price elastic compared to those of the other countries. This potentially explains the relatively smaller share of selections for this alternative in the German sample. Price sensitivity is almost identical among UK and French participants, while US participants are the most tolerant of increases in TVOD price.²⁰ Similarly, (ISANON) VPN price elasticity is also lowest among German participants. Again, this may reflect the low existing levels of piracy in Germany. UK participants are the most sensitive to changes in punishment probability. We refrain from making cross-country comparisons regarding advertising elasticity due to this attributes insignificance in three out of four countries.

²⁰ We note price elasticities below one typically imply prices below profit maximising levels. However, in the context of the DCE (where individuals are primed with respect to ‘a film they are expected to enjoy’), we might expect participants to exhibit relatively more inelastic demand relative to overall demand. It is therefore difficult to speculate whether observed prices are too low from a profit maximising perspective.

Table 5 Elasticities

Country/ attribute	Alternative				
	TVOD	AVOD	IS	ISANON	NONE
<i>US</i>					
PRICE	-0.64	0.41	0.06	0.11	0.06
ADVERT†	-0.05	0.08	-0.01	-0.01	-0.01
PUNISH	0.07	0.11	-0.32	0.12	0.01
VPNPRICE	0.18	0.17	0.14	-0.51	0.02
<i>UK</i>					
PRICE	-0.81	0.57	0.02	0.10	0.12
ADVERT	0.10	-0.15	0.01	0.02	0.02
PUNISH	0.08	0.22	-1.09	0.68	0.11
VPNPRICE	0.08	0.10	0.12	-0.35	0.05
<i>Germany</i>					
PRICE	-1.65	1.04	0.06	0.27	0.27
ADVERT†	0.01	-0.02	0.00	0.00	0.01
PUNISH	0.07	0.19	-0.34	0.07	0.01
VPNPRICE	0.30	0.40	0.07	-0.85	0.08
<i>France</i>					
PRICE	-0.80	0.51	0.07	0.10	0.13
ADVERT†	-0.02	0.03	0.00	-0.01	-0.01
PUNISH	0.08	0.13	-0.48	0.21	0.06
VPNPRICE	0.05	0.09	0.10	-0.27	0.03

Bold represents elasticity of alternative with respect to its own respective attribute

†Denotes that elasticities are derived from an insignificant parameter in the mixed logit model

Cross-attribute elasticities permit examination of substitution patterns between AVOD and the other alternatives. For each country sample, increases in TVOD price primarily result in a substitution to AVOD, as opposed to the illegal alternatives. This is particularly pronounced among German participants. Increases in punishment probabilities have varying effects across the different countries. In the US sample, substitution to legal alternatives is slightly higher than substitution to the other illegal alternative (ISANON). In the UK and French samples, increases in punishment probability cause substitution primarily to ISANON, with only limited substitution to the legal alternatives. German participants are the most likely to move to legal platforms when punishment probability increases.

Overall, however, increases in punishment probability lead to more participants switching to AVOD rather than TVOD in all countries. Higher VPN prices also push participants towards legal alternatives in all countries. In the US and UK samples, the increased share of legal selections is evenly split between AVOD and TVOD. However, in German and French samples AVOD is the main benefactor of increases in VPN price. In the UK sample, the only country where the advertising attribute is significant, it is evident that increasing advertisements pushes participants towards

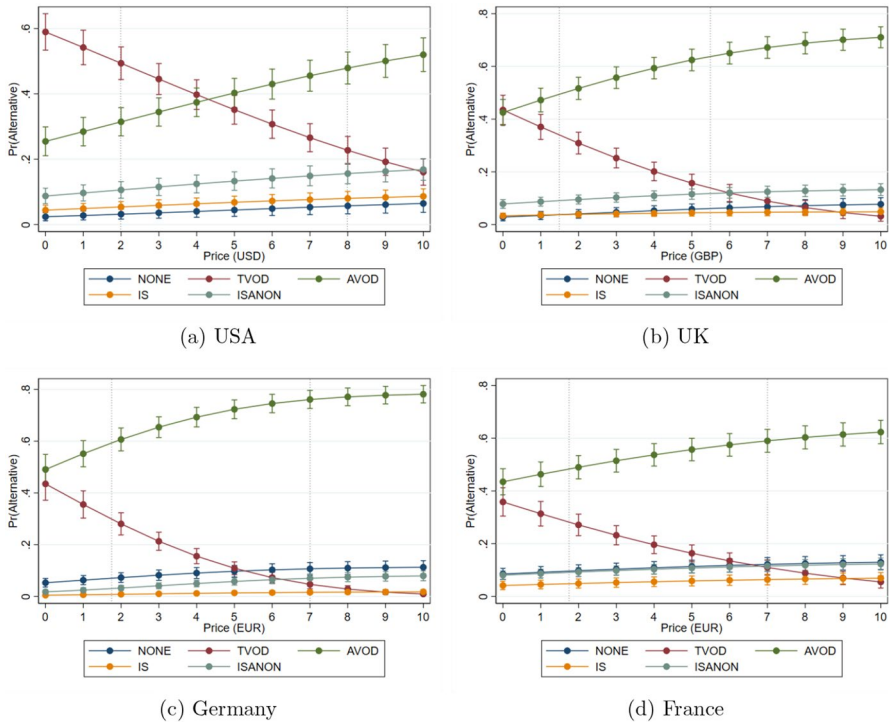


Fig. 2 Predictive margins—price

TVOD. There is very little substitution to illegal alternatives when advertising is increased.

4.4 Predictive margins

The elasticities presented in Table 5 offer preliminary insights into patterns of substitution among the four alternatives, but contain no information about the actual probabilities that specific individual alternatives will be selected as attribute levels vary. Figures 2, 3 and 4 permit such analyses by examination of the predictive margins associated with the price, punishment and VPN price attributes. In each plot, the vertical dotted lines represent the lower and upper bounds of attribute levels presented to participants in the DCEs. Beyond these, we can use the predictive margins to make inferences outside the ranges used in the experimental design, as defined in Table 2.

Figure 2 confirms that increases in (TVOD) price decrease the probability of TVOD being chosen in all country samples, where AVOD is consistently the main beneficiary in terms of substituted choice probability. While increases in price do increase the choice probabilities for the two illegal alternatives, in particular ISANON, it is to a much lesser extent than AVOD. This demonstrates that although the

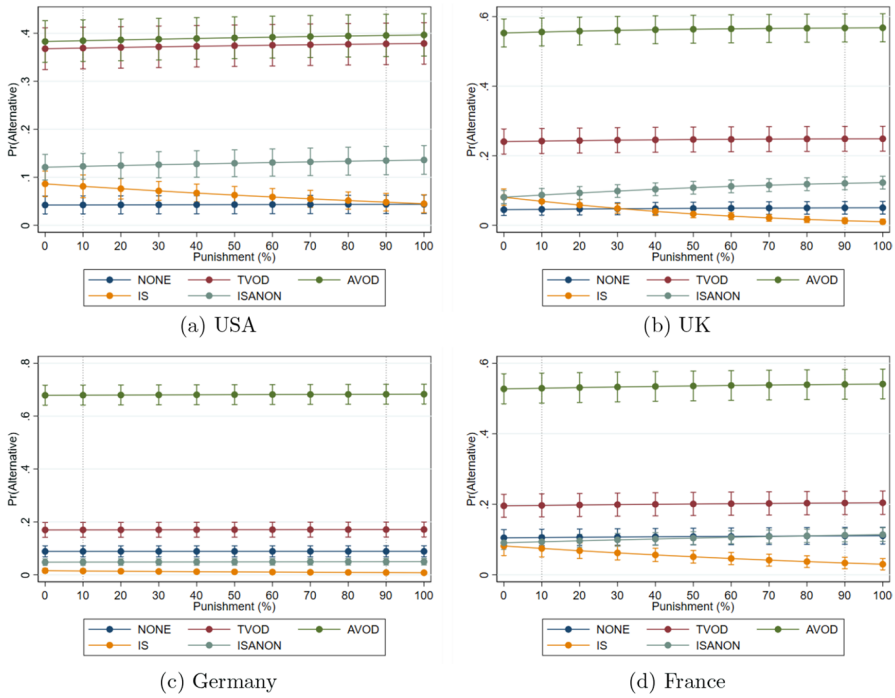


Fig. 3 Predictive margins—punishment

majority of participants substitute between legal alternatives, increased price does drive up the probability of illegal consumption. This is particularly the case in the US sample. The predictive margins for price also offer visual evidence of the higher willingness to pay for TVOD content in the US sample, when compared to other countries. Notably, the point at which the probability of choosing AVOD and TVOD is equal occurs at a price of just over US\$4, whereas in the other countries majority acceptance of TVOD is only found when the price tends towards zero.

The downward sloping predictive margins for the IS alternative in Fig. 3 reveal that increases in punishment probability decrease the choice probability of this alternative. However, the effect is small, particularly in the German sample. In each country at least a proportion of this decrease substitutes towards ISANON. This indicates that some viewers will simply choose to hide their illegal consumption via a VPN in response to tighter piracy regulation, rather than shift to a legal alternative.

Finally, with respect to the predictive margins for VPN price presented in Fig. 4, an increase in VPN price leads to a decrease in the probability of choosing ISANON. This is particularly pronounced in the USA, UK and French samples. While there is some substitution towards IS, the other illegal alternative, increases in the price of VPN services also increase the likelihood of choosing a legal platform for all countries. This suggests that there may be some scope to curtail illegal consumption via

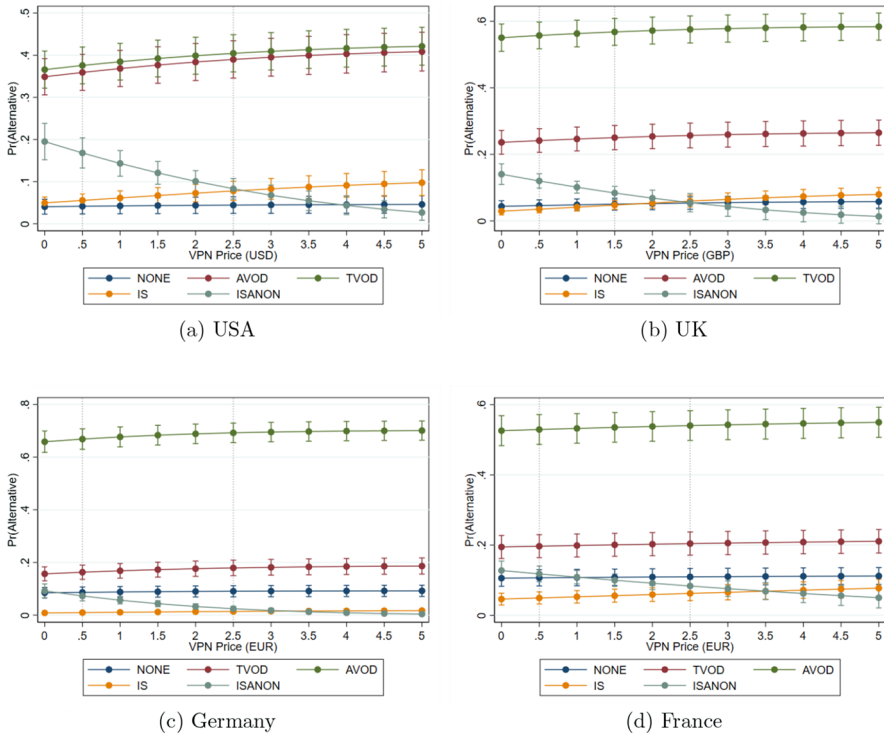


Fig. 4 Predictive margins—VPN price

the regulation of VPN services.²¹ We discuss this in more detail in our concluding remarks.

4.5 Simulated AVOD entry

The preceding analyses have been implicitly based on a hypothetical market situation where the AVOD alternative is consistently available alongside the other platforms. However, for the majority of new-release films, this is not an accurate depiction of current reality, as distributors do not typically offer TVOD and AVOD at the same time. While there is some evidence such a business model is emerging, it has yet to become commonplace. For these reasons, it is of interest to examine how the current business model (without AVOD) would be impacted by the new entrant. To this end, we use our model estimates to simulate the AVOD entry by comparing predicted choice probabilities for the different alternatives with and without AVOD in the choice set. The results of this exercise are reported in Table 6.

²¹ VPNs are only strictly illegal in four countries (Belarus, Iraq, North Korea and Turkmenistan) and restricted in six other nations, potentially validating such scope for regulation. See: <http://forbes.com/advisor/au/business/software/are-vpns-legal>.

In the US sample, the introduction of AVOD results in a similar relative decrease in the share of TVOD and the no choice option. There is also evidence that the entry of AVOD reduces the relative share of IS and ISANON by just over a third and a quarter, respectively. A similar pattern is found in the UK and French samples, albeit with larger relative decreases in the share of the incumbent alternatives due to the higher popularity of AVOD services in these markets. In the German sample, we observe a large relative decrease in the share of illegal alternatives, albeit from a relatively small base. Indeed, the entry of AVOD decreases the market share of IS from 10 to 2%, nearly eliminating anonymous piracy.

These estimates can be used in a back-of-the-envelope exercise to determine the amount of ad revenue necessary to offset declines in TVOD revenue from the entry of the AVOD alternative. Taking the case of the USA, assume an incumbent TVOD provider decides to entirely forego TVOD and instead relies solely on AVOD revenues. With a potential market size M and TVOD price p , the decline in revenue becomes $0.61 * p * M$. Assuming a market size of 100,000 and price of \$4.99 (the mid-point price from Table 2), this equates to foregone revenue of approximately \$304k that would have to be recovered from advertisers. Using the same assumed market size and price, if the incumbent TVOD provider decided instead to *complement* the TVOD service with AVOD, the drop in TVOD revenue (and required off-setting ad revenue) is now only \$130k based on a reduction in market share of 26%.

It is possible to go a little further with such calculations by making assumptions about how AVOD revenues are generated. Advertisers on these platforms typically pay for this service as ‘cost per view’.²² Assuming 30 s ads and a typical movie contains a total of 30 min of ads (Table 2), this permits 60 ad slots. Letting c equal advertising cost per view, total AVOD revenue becomes $c * 60 * 0.37 * M$ based on the US case where AVOD attracts 37% market share. In order to offset the decline in TVOD revenue, it is straightforward to show c must be greater than \$0.058. Similar calculations for UK, Germany, and France yield £0.041, €0.028, and €0.041, respectively. These estimates are consistent with industry reported CPMs. For example, S & P Global Market Intelligence reports an average CPM of \$45.03 for prime-time viewing, which equates to a cost per view of \$0.045.²³

4.6 ZOIB alternative selection model

As discussed in Sect. 3, beyond the DCEs, we collect additional data about participants with respect to time and risk preferences; attitudes, experience, and beliefs about piracy; and basic demographic information. We incorporate a selection of these variables into four ZOIB models for each country, where participants are the unit of observation. In these models, the dependent variable is essentially the proportion of times each alternative was selected across the 12 choice tasks, which are further categorised as *never* (i.e. zero selections of alternative), *sometimes* (i.e. a

²² Industry language around this metric is expressed slightly differently in terms of ‘cost per one thousand impressions’ (CPM).

²³ See <https://www.spglobal.com/marketintelligence/en/news-insights/latest-news-headlines/upfront-prime-time-pricing-increased-significantly-but-volume-wobbled-65519698>.

Table 6 AVOD entry simulation

	Without- AVOD (%)	With- AVOD (%)	Absolute change (%)	Relative change (%)
<i>US</i>				
TVOD	61	35	-26	-42
AVOD		37		
IS	12	8	-4	-36
ISANON	19	14	-5	-26
NONE	8	5	-3	-41
<i>UK</i>				
TVOD	64	25	-39	-61
AVOD		55		
IS	7	4	-2	-36
ISANON	16	11	-6	-35
NONE	13	5	-8	-64
<i>Germany</i>				
TVOD	42	18	-24	-57
AVOD		64		
IS	10	2	-7	-76
ISANON	13	7	-7	-50
NONE	35	9	-26	-75
<i>France</i>				
TVOD	50	21	-29	-58
AVOD		53		
IS	12	6	-6	-49
ISANON	18	11	-7	-39
NONE	21	10	-11	-53

proportion greater than zero but less than one selections of alternative), or *always* (i.e. 12 selections of alternative). The zero/one selections are modelled using logit regressions, and the non-zero/one proportions using a beta regression.

As independent variables, we include time preference, risk preference, and variables concerning attitudes, experience, and beliefs about piracy.²⁴ Also, demographic variables related to age, gender, education, and weekly income are included in all models. Due to sparsity over various survey responses, we coarsen responses to a number of survey questions to minimise excessively large standard errors. As described in the Online Appendix, we operationalise 'time preference' as the number of minutes break in survey completion tolerated by the respondent, ranging from 0 (time poor) to 20 (time rich). 'Risk preference' is operationalised as the number of risk-seeking choices made by the respondent in the Holt-Laury risk-elicitation test, ranging from 0 (risk averse) to 10 (risk loving).

²⁴ See Online Appendix Table A.1.

Online Appendix Tables A.2–A.5. provides results of the ZOIB models. The time- and risk-preference variables do not show any evidence of affecting alternative selection across the countries. There are a number of possible explanations for the lack of such evidence. Regarding time preference, potentially the experimental design of being compensated for *additional* time delay is viewed differently from having to pay to *avoid* time delay, as would be the case in selecting TVOD over AVOD. A different explanation could be that such delays are now routinely tolerated by consumers given their ubiquity in media consumption.

Regarding risk preference, there are also different potential explanations why no relationship was found. Similar to time preference, one explanation could relate to framing given the experimental design provides *positive* rewards (albeit with low-probabilities for higher rewards), whereas the actual punishment from copyright infringement would be a *negative* payoff (e.g. fine). Other explanations are also possible. For example, the two types of risk might be perceived differently given one relates to a gamble (generally, a legal activity), whereas the other relates to an illegal activity, where potential punishment is not the only factor of consideration.

Regarding questions related to illegal piracy attitudes, across countries there is no connection between a participant's views on acceptability of piracy and their choice of alternative. On the other hand, reported actual illegal consumption is generally positively associated with an increased probability of selecting both illegal alternatives (IS and ISANON) across all countries to some degree. This is most obvious in the zero-inflated components of the ZOIB models, where the interpretation is that individuals who have reported actual illegal consumption are less likely to never select an illegal alternative. While this finding is perhaps not unsurprising, it is helpful to alleviate concern about the willingness of participants to select illegal alternatives in the experimental setting.

There is also little evidence that perceived punishment or detection probability influences platform choice across each country. Similarly, there is little evidence of any of the demographic variables associating with selection of alternatives. Taken together, and with the exception of actual illegal downloading experience, the results suggest little relation among any of the other variables and selection of alternatives. Interpreted differently, beyond the variables used in the DCE, individual selections seem to be guided most by habit and familiarity with little connection to the variables considered in the survey analysis.

5 Summary and conclusions

This paper investigates platform preferences for in-home viewing of new-release films in four major developed countries. This research is undertaken in light of increasing market disruption from AVOD and the persistence of illegal streaming among viewers. The empirical methodology utilises stated-preference discrete choice experiments for representative samples of each selected country. Insights from our analyses hold the potential to inform content providers, advertisers, and policymakers.

Viewers across all four countries show a preference for the use of AVOD services to watch new-release films. Over 25% of participants exclusively select this platform, suggesting AVOD has the potential to disrupt the incumbent TVOD model and help tackle the resurgence of digital piracy. Preferences for AVOD services are highest in the European countries, pointing to potential institutional and cultural explanations for this distinction.

Choice of AVOD appears unrelated to the total amount of advertising time in all countries except the UK, though even in this country the relation is not particularly strong. As digitisation has normalised the exchange of advertising in return for free content, an overall tolerance of advertising may not be surprising. This finding also supports recent industry surveys that point to increasing evidence of ‘digital subscription fatigue’, which is driving viewers from paid to free content. Anecdotal evidence suggests that broadcasting companies and commercial providers are already taking advantage of the stoic behaviour of their customers via longer advertisement breaks over time.

Our estimates of substitution patterns reveal a number of findings concerning preferences for AVOD *vis-à-vis* TVOD and the two illegal alternatives. Notably, price of TVOD alters preferences towards AVOD strongly in all countries. Potential punishment and VPN price also play a role in the substitution patterns, and particularly towards the AVOD alternative rather than TVOD or the outside option. Results from the simulation exercise reveal that AVOD entry has the potential to draw consumers from all other alternatives. In terms of absolute magnitude, this was observed most dramatically with respect to TVOD for all countries except Germany, where the outside good exhibited the greatest absolute decline. Simple back-of-the-envelope calculations revealed that the implied cost-per-view advertising rates to offset foregone TVOD revenues are consistent with current observed industry levels.

Another key finding is that unlawful options are popular with some viewers. Overall, 30% of participants were willing to engage in some form of illegal viewing. This is particularly evident with respect to the VPN-enabled alternative, which is sensitive to price. The ZOIB model results reveal previous piracy experience also affects both types of unlawful choice. Illegal alternatives in Germany are less likely to be selected compared to other countries, which may be due to more awareness of sanctions for transgressors. It should be noted that punishment probability is effective in regards to illegal streaming in all sampled countries except Germany, where illegal streaming is already significantly lower.

Future research is warranted in various directions. First, it is of interest to explore other markets to establish the geographical transferability of the results and shed light on cultural differences in consumption norms. This would be particularly useful in important emerging markets, such as China and India. Second, while this study focuses on in-home movie consumption, preferences may vary for different types of content. For example, preferences for television series, news, sport, music, and other forms of digital entertainment.

Third, although this study examines participants’ attitudes towards the *duration* of advertising breaks, it doesn’t allow us to draw conclusions about advertising *effectiveness*. Even though the average viewer currently faces difficulties in ad blocking on VOD platforms, technological advancements in this area might simplify

this process in the future. Additionally, viewers might utilise advertising breaks to step away from the screen for various purposes. Given that the success of AVOD platforms hinges on viewer engagement with advertising, further exploration of such factors is warranted.

Fourth, while discrete-choice experiments are implicitly vulnerable to hypothetical bias, we have attempted to partially address this by incorporating incentivised behavioural experiments. While these did not directly influence our main results, it is not clear whether this occurred because the contexts were not sufficiently comparable or the incentives were not well aligned. Future work could examine alternative ways to incorporate incentive-compatible behavioural experiments into stated preference models.

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Declarations

Conflict of interest The authors declare that they have no conflict of interest.

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