

**WEBSITE BLOCKING REVISITED:
THE EFFECT OF THE UK NOVEMBER 2014 BLOCKS ON CONSUMER BEHAVIOR**

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This Version: April 2016

Acknowledgements: This research was conducted as part of Carnegie Mellon University's Initiative for Digital Entertainment Analytics (IDEA), which receives unrestricted (gift) funding from the Motion Picture Association of America. All findings and errors are entirely our own.

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ABSTRACT

Whether and how copyrights should be enforced in the digital age has become an important policy question and an important question for empirical research. In a prior study, we found that the court ordered blocking of the Pirate Bay website in the UK in April 2012 had only a small impact on total piracy and no impact on paid legal streaming, but that the blocking of 19 major piracy websites in November 2013 caused a significant decrease in total piracy and a significant increase in usage of paid legal streaming sites.

In this update, we ask whether the blocking of 53 piracy websites in the UK in November 2014 — which more than doubled the total number of sites being blocked in the country — had an impact on consumer behavior and how that impact compared to the previous blocks. We found that these blocks caused a 90% drop in visits to the blocked sites while causing no increase in usage of unblocked sites. This led to a 22% decrease in total piracy for all users affected by the blocks (or a 16% decrease across all users overall). We also found that these blocks caused a 6% increase in visits to paid legal streaming sites like Netflix and a 10% increase in videos viewed on legal ad-supported streaming sites like BBC and Channel 5.

The evidence suggests that blocking large numbers of sites can still “move the dial” in terms of consumer behavior, but that there may be diminishing returns as remaining pirates may be more dispersed or else have lower willingness to pay for legal content. Nonetheless, such blocks can serve to mitigate the possibility of a long-term return to the prior status quo.

Keywords: *Piracy, regulation, digital distribution, motion picture industry, natural experiment.*

1. Introduction

In recent years, website blocking has become a primary tool in the attempt to mitigate the impact of online piracy on media sales. This study analyzes the effect of the UK court ordered blocking of 53 different piracy sites in November 2014 on consumer behavior across legal and illegal media channels. It is intended as an update to earlier work on website blocking in the UK.

Blocking access to sites that enable copyright infringement has the potential to make it harder for consumers to find pirated copies of media goods and thus it may diminish the appeal of illegal sources relative to legal ones. However, due to the vast supply of illegal sources for copyrighted works online, it is not always clear if blocking a particular website or set of websites will actually diminish the appeal of piracy. For example, if a consumer wants to pirate a copy of *The Avengers* movie and she knows three illegal sites from which she can reliably obtain a copy, blocking access to one of those sites may have no impact on her behavior. However, if all three sites are blocked, she has the choice of paying a cost (i.e. facing a search cost or a learning cost) to discover new reliable illegal sources or paying the legal price and easily obtaining a legal copy from a trusted source.¹

Prior theoretical work has established that indeed, when supply side piracy interventions (such as website blocking) are enacted, there are several possible equilibrium outcomes. From the perspective of theory, when the intervention is not strong enough, there will be no effect on total piracy or on legal consumption. But when the strength of the intervention clears a certain threshold, the action reduces total piracy and increases legal sales (Dey et al. 2015). Empirical findings have generally been consistent with this theoretical result. Danaher et al. (2015) found that court ordered blocking of The Pirate Bay in the UK caused only a small decrease in total

¹ This legal “price” may be a financial price or the inconvenience (disutility) of watching advertisements.

piracy levels because most former users of The Pirate Bay switched to other unblocked piracy sites. Thus, the event did not cause any increase in paid legal streaming of movies or television. However, when 19 major piracy sites were simultaneously blocked in November 2013, Danaher et al. found that this action caused a meaningful reduction in total piracy levels in the UK and also caused a statistically and economically significant increase in usage of paid legal streaming sites (like Netflix).

It is theoretically ambiguous what effect the UK blocking of 53 piracy websites in November 2014 would have on consumers. On one hand, the blocking of only 19 sites had a significant impact, and so one might hypothesize that blocking 53 sites should have at least as powerful an impact. It is also true that legal distribution channels such as Netflix were more established in 2014 than they were previously, and thus they may have presented a more appealing alternative to piracy than was the case in 2012 and 2013. On the other hand, usage of the sites that were blocked in 2014 was much less concentrated than usage among those that were blocked in 2012 and 2013, which may weaken the impact of the 2014 blocks on consumer behavior. It is also possible that the remaining illegal consumers in 2014 were more technically savvy consumers (with less technically savvy consumers having been dissuaded by the 2013 blocks) and, as a result, these users will find it easier to locate alternative piracy sites than the consumers who were blocked in 2013. Thus, the impact of the 2014 blocks is an open empirical question.

We analyze this question using a similar set of data to Danaher et al. (2015) and the same methodologies. We find that the impact of the 53 site blocks in November 2014 on total piracy and on legal consumption was greater than the impact of the blocking of The Pirate Bay but smaller than the impact of the nineteen site blocks in November 2013. Due to the availability of more granular data for the 2014 blocks, we are also able to show that the increase in legal con-

sumption was distributed across both ad-supported and paid subscription streaming sites. In the final section we discuss our interpretation of these results and what they may mean for the future of website blocking in the UK.

2. Background

Danaher et al. (2015) describe the importance of the film industry in the world economy and summarize the research on the effect piracy has on film and television. They also describe the various strategies that governments and firms have implemented to mitigate this effect.

One of these strategies involves legal requirements for Internet Service Providers to block access to sites providing copyright infringing content. For example, in April 2012 the UK courts ordered five major ISPs to block access to The Pirate Bay, one of the most popular piracy sites in the world (with reportedly 3.7 million UK users).² In October and November of 2013, the courts ordered the same ISPs to block access to 19 different website that enabled access to copyright infringing content. These two blocking actions were the subject of the empirical research in Danaher et al. (2015).

More recently, in February 2014 the courts ordered four more piracy sites to be blocked, including the popular website watch32.com. Then, in November 2014, the courts ordered six major ISPs in the UK to block access to 53 different sites/services,³ bringing the total number of blocked sites to 93.⁴ Thus, the set of blocks in November more than doubled the number of blocked piracy sites, and the goal of our research is to evaluate whether these blocks had an impact on consumer behavior and if so, how.

² <http://www.theguardian.com/technology/2012/apr/30/british-isps-block-pirate-bay>

³ A list of the 53 blocked sites can be found in Appendix I.

⁴ <http://www.bbc.com/news/technology-30234790>

It is clear why one might expect these blocks to reduce piracy and increase legal consumption, given the number of sites blocked. However, there are three primary reasons why the blocks may have less of an impact than earlier blocks:

1. A large proportion of piracy was concentrated among the 19 sites blocked in November 2013. Whatever piracy remained after those blocks may have been significantly more dispersed across other sites, making it harder to have an impact on behavior by blocking a limited number of sites. Whether the 53 sites blocked in November 2014 constituted a meaningful amount of total piracy to “move the dial” is part of the question we answer in this research.
2. Consumers who were dissuaded from piracy by the November 2013 blocks may have been less technically savvy internet users, such that blocking 19 sites made piracy inconvenient enough for them to want to increase their consumption through legal channels. If the remaining users of illegal sites were more technically savvy, they may have found it easier to learn where the newest or most reliable remaining piracy sites were located. If this is true, then it may be difficult to block enough sites to impact their behavior.
3. Consumers remaining on piracy sites by November 2014 may have had lower willingness-to-pay (WTP) for legal products than pirates from before the 2013 blocks. For example, if there were 100 pirates in 2013 and 40 of them had a Netflix subscription (or were very close to wanting to buy one), it may be these 40 who chose to consume more through Netflix after the November 2013 blocks. In this case, the remaining 60 pirates, even if they were inconvenienced by the November 2014 blocks, may simply be the exact consumers who are less interested in paying for Netflix and simi-

lar legal services. Thus the 2014 blocks could have a smaller impact on legal consumption than prior blocks.

For these reasons, it is not clear what the marginal impact of additional website blocking will be, and thus it is unclear whether there are proportional returns to scale from additional blocks, or if returns are diminishing.

3. Literature Review

Our research in general fits into several streams of the academic literature.

First, research in economics and in information systems has asked whether piracy harms sales. The vast majority of studies find evidence that piracy of media content does displace sales of that content, including Rob and Waldfogel (2006), Danaher et al. (2010), Zentner (2012), Danaher and Waldfogel (2012), and Ma et al. (2014). Nonetheless, several studies indicate no impact from filesharing, including Oberholzer-Gee and Strumpf (2007) and Smith and Telang (2010).

Second, researchers have asked whether reduced revenue caused by piracy has impacted the supply of creative works. Waldfogel (2012) finds that the reduced costs of production, promotion, and distribution of music has offset the revenue losses due to piracy, and that there has subsequently been no decline in the supply of music that surpasses a certain quality threshold. Waldfogel (2015) also finds that in movies, due to reduced costs of bringing products to market and to the ex-ante unpredictability of a movie's ex-post success, the overall effect of digitization has been to increase the number of films being released and also the value that consumers get from these movies. Both of these studies examine situations where piracy was accompanied by meaningful reductions in the cost of production. In contrast, Telang and Waldfogel (2015) stud-

ied the explosion of VCR piracy in India starting in 1985, an event that was not accompanied by cost-saving digital technologies. In this context, they found that increased piracy and lax intellectual property protection led to a decrease in the number of films produced and also a decrease in the quality of those films that were produced, according to ratings on imdb.com.

Finally, researchers have asked what policies or strategies can mitigate the impact of piracy on sales. Dey et al. (2015) use an analytical modeling approach to demonstrate that supply side policies (which target sources of piracy) will have better social outcomes than demand side policies (which target consumers of pirated goods). Several empirical studies (Danaher et al. 2014, Danaher and Smith 2014, Adermon and Liang 2014) demonstrate that government interventions targeting copyright infringement can reduce piracy, and that legal sales increase under such policies. But, Adermon and Liang also find that when enforcement of antipiracy policies loses credibility, piracy and sales revert to their original levels. Peukert et al. (2015) also suggest that the benefits of antipiracy interventions may be limited to more popular products rather than “long tail” products, at least in the context of the shutdown of Megaupload.com and its effects on film box office performance.

Our present analysis is an extension of the research conducted in Danaher et al. (2015), where we examined the impact of The Pirate Bay block in April 2012 and the 19 site blocks in the UK in November 2013. In the next section, we will describe our data and several ways in which it differs from the dataset in the prior study.

4. Data

We obtained data on the monthly behaviors of a panel of 58,809 UK Internet users from August 2014 to February 2015, which includes the three months before the blocks (August-October), the month of the blocks (November), and the three months after the block (December-

February). The data were obtained from PanelTrack, the same source as that in our previous work on UK website blocking. We do not observe the behavior of each user — rather, users are segregated into 10 different segments based on the number of times they visited the blocked sites during August and September of 2014. The control group includes users who did not visit the blocked sites at all during these months, while the tenth segment includes users who visited the blocked sites over 35 times during August and September. We observe the aggregated number of visits (and time spent) to different categories of sites for each segment during each month. In particular, we observe visits to blocked sites, visits to alternate unblocked piracy sites, visits to VPN sites, visits to legal ad-supported video sites (for example, the BBC iPlayer or Channel 5’s “Demand 5” streaming website),⁵ and visits to legal subscription based sites (e.g. Netflix or Amazon Prime). For the legal advertising supported streaming sites, we also observe the actual number of videos viewed on those sites, although we unfortunately do not observe this for subscription based sites. We also do not observe information related to behavior at download or rental sites. Purchases at such sites are very difficult to track, and visits to such sites have been suggested to have only a weak correlation with purchases.⁶

For our analysis, we drop observations from the month of November. The first court orders came at the end of October and the rest came in mid-November. Because it might take ISPs a few weeks to implement the blocks, November was a transition month in the blocking of these sites. We consider the pre-block period to be August-October 2014, and the post-block period to

⁵ Notably, we did not include YouTube in ad-supported streaming. The vast majority of content on YouTube is comprised of short-form or user generated videos that are unaffected by piracy and thus would be unaffected by the blocks. But YouTube visits dwarf visits to all of the other ad-supported streaming sites, and so including these visits would make it extremely difficult to detect any effect of the blocks on legal consumption of content that is actually being pirated.

⁶ For example, the largest such site is iTunes, which is usually used as an app as opposed to as a storefront or website. This app is “opened” every time someone boots up their computer or plugs in their iOS device, though these events rarely lead to a purchase.

be December 2014 — February 2014. Of course, there are many factors that could affect trends in media consumption (legal and illegal) from the pre to the post period. For example, very popular shows like Downton Abbey are typically released in the early Fall, and consumption of these shows may taper off in January and February of the following year. Following Danaher et al., we account for these time trends by examining the changes across different segments, and asking if the segments more heavily affected by the blocks (those using the blocked sites more) make larger changes in behavior than those less affected.

Table 1 describes the segments in our data and their usage of various media-related websites during the pre period.

TABLE 1 — DESCRIPTIVE STATISTICS

Consumer Segment	Users in Segment	Avg. Visits to Blocked Sites Per User	Total Piracy Visits	Legal Ad-Supported Visits	Legal Subscription Visits	VPN Visits
0	53,273	0	138,257	61,967	57,475	4,854
1	1,737	1	31,553	6,610	7,692	390
2	801	2	18,027	2,346	3,322	147
3	451	3	15,073	2,286	1,871	166
4	319	4	11,665	1,119	1,301	18
5	426	5.4	15,802	1,590	1,968	229
6	478	8.3	23,118	2,389	2,666	71
7	396	13.2	28,988	1,999	3,446	524
8	502	23.8	56,917	3,448	3,018	115
9	426	78.6	140,423	3,178	2,496	28

Note that sample sizes across segments are not equal. Clearly though, each segment was constructed to have differing levels usage of the blocked sites before the blocks occurred, meaning that each segment received a different level of treatment intensity from the blocks. Segment nine, the heaviest users of the blocked sites, are also the heaviest pirates in general as their total piracy visits are larger than every other segment including even segment 0, in spite of the fact

that segment 0 has 125 times more users than segment 9. Simply put, segment 0 users are only very infrequent pirates, while segment 9 are the most intense pirates. Segment 9 was most impacted by the blocks since the average user in that segment visited the blocked sites almost 80 times before the blocks, while segment 0 were non-users of the blocked sites.

We also observe that, consistent with prior literature, the heaviest pirates are also heavier users of legal sites than the lighter pirates, reflecting the fact that individuals with strong preferences for consumption of television and movies tend to consume more television and movie content, through both pirate and legal channels. The question is whether these heavy pirates would have higher legal consumption in the absence of piracy, or in this case whether removing access to some of the piracy sites can induce these heavy pirates to make more use of legal channels.

Finally, it is important to note that the data indicate that the blocks were effective at reducing traffic to blocked sites. In the data, we observe a total of 86,735 visits to blocked sites in the pre-period. However, in the post period, we observe only 10,474 visits to blocked sites, indicating nearly a 90% drop in visits to blocked sites. There are several potential reasons for why the drop was not 100%. First, some ISPs may not have blocked all of the sites until some time in December, depending on how long it took them to comply. Second, some smaller ISPs were not targeted by the court orders and thus did not participate in the blocks. Finally, some consumers may have used VPNs to access the blocked sites, and such visits might show up in our data. Nonetheless, with a 90% drop in visits to blocked sites, it is clear that the blocks constitute a meaningful experiment as a negative shock to piracy at the blocked sites.

5. Empirical Model and Results

To determine the impact of the November 2014 blocks on various consumer behaviors, we run the following difference-in-different model:

$$LnVisits_{jt} = \beta_0 + \beta_1 After_t + \beta_2 TreatIntensity_j * After_t + \mu_j + \varepsilon_{jt} \quad (1)$$

where $LnVisits_{jt}$ indicates the natural log of visits (to whatever category of sites we are examining) made by consumer group j during period t . $After_t$ is a dummy variable equal to one if the month is December 2014, January 2015, or February 2015. By including this variable, we control for differences between the pre-block period and the post-block period that would, on average, affect all segments evenly, such as any outside factors which increase or decrease the appeal media consumption, piracy, or VPNs (for example, the quality of content released or being offered at the time of observation). $Treatintensity_j$ indicates the number of visits that the average consumer in group j made to the 53 blocked sites during August and September of 2014. Finally, μ_j is a vector of group fixed effects and ε_{jt} is an idiosyncratic error term. In this model, β_2 is the variable of interest and, under the assumption that each group's trend after the block would have been uncorrelated with that group's treatment intensity, it indicates the causal impact of the block on visits to sites in the outcome group in question.

Table 3 below shows the results from model (1) for various outcome variables.

TABLE 2 — EFFECT OF NOVEMBER 2014 SITE BLOCKS

	Unblocked Piracy	VPNs	Legal Ad-supported	Legal Subscription
After Block	-1.053* (0.001)	-1.500* (0.004)	-0.586* (0.000)	-0.619* (0.000)
TreatIntensity * After Block	-0.002 (0.380)	0.030+ (0.066)	0.005** (0.050)	0.004 (0.251)
Constant	10.178* (0.000)	5.148* (0.000)	8.131* (0.060)	8.217* (0.000)
Observations	20	20	20	20
Consumer groups	10	10	10	10
R-squared	0.979	0.851	0.99	0.97

p-values in parentheses calculated based on a t distribution with 8 degrees freedom (# groups - 2)

+ significant at 10%; ** significant at 5%; * significant at 1%

First, note that the “after block” term is negative for all variables. The most likely explanation for this is a strong negative trend in interest in media consumption over this time. Some very popular shows are released in the UK in the fall, and it may be that interest drops off greatly during the winter. Our identification strategy controls for this by looking at how each group’s behavior differs from the general trend.

The coefficient of interest (treatintensity * after) is small, negative, and statistically insignificant for unblocked piracy sites. This indicates that the blocks did not cause former users of blocked sites to increase their consumption at other illegal sites. This is consistent with prior results. Danaher et al. showed that when one site was blocked (Pirate Bay), many users of that site moved to other unblocked piracy sites. But when 19 sites were blocked, there was only a small and statistically insignificant increase in usage of unblocked sites, presumably because

consumers had more difficulty finding the remaining piracy sites. In this analysis, we find that when 53 sites are blocked, there is no causal increase in usage of unblocked piracy sites. The most likely explanation is that users of these sites found it difficult to learn about other illegal sites that they could trust after 53 of the most popular sites were blocked.

Some users of the blocked sites, however, did seem to employ technical workarounds to continue usage of the blocked sites. The coefficient of interest for visits to VPN sites is positive and significant at the 90% confidence level, indicating that for every 10 additional visits to blocked sites before the blocks, a consumer increased their visits to VPN sites after the blocks by an additional 30%. Table 1 shows that VPN usage in the data was still small relative to usage of other sites, but one visit to a VPN site can facilitate multiple private (and unblocked) visits to other sites, and so this causal increase in usage of VPN sites may indicate a number of Internet users employing VPNs to circumvent the blocks. This is consistent with the findings from the Pirate Bay and November 2013 blocks. In spite of this increase in VPN usage however, our data show the blocks caused a decrease in total piracy.

Turning to legal sites, we find a positive and statistically significant increase in usage of ad-supported sites. A 10 visit increase in pre-block visits to blocked sites is correlated with a 5% larger increase (or smaller decrease) in visits to ad-supported legal streaming sites after the blocks.⁷ This indicates that the blocks caused an increase in visits to legal ad-supported video sites. Notably, for this particular category of sites, we also have data on the number of videos actually viewed (as PanelTrack collects these data). When “visits” is replaced with “videos viewed”, the results are nearly identical in that the interaction coefficient remains 0.005 and it is measured with 90% confidence. This not only indicates that the blocks led to more legal video

⁷ For both ad support legal sites and subscription legal sites, we tested a quadratic interaction term as in Danaher et al. (2015). In both cases, the linear model was a better fit.

viewing (and thus advertising revenues) at ad-supported sites, it also provides some validation for our use of “site visits” in other categories as a proxy for viewing videos at those sites.

Finally, the interaction term for paid subscription-based legal streaming sites is positive and similar to that for ad-supported sites, although it is only measured with 75% confidence. The point estimate indicates that a 10 unit increase in visits to blocked sites before the blocks is correlated with a 4% increase in usage of paid subscription sites after the blocks. We note that this is smaller than the coefficient found for the November 2013 blocks. We will discuss the importance of this and the total causal increase in the next section. The fact that the coefficient for ad-supported legal sites is similar to that for subscription-based legal sites is intuitively appealing. Both categories of sites allow for unlimited “free” viewing of videos, at least if one has already paid the subscription price for the second category. Thus, it may not be surprising that both categories of sites receive similar uplifts from the blocks.

In Table 3 we report the estimated causal change in total piracy and each type of legal viewing for each segment based on our model estimates. Importantly, one should recall that the estimate for ad-supported viewing was measured with 95% confidence, while the estimate for subscription was measured with 75% confidence. These two estimates are derived directly from the coefficients from the regression model. However, the causal change in total piracy is computed differently. First, we assume that the immediate drop in piracy at blocked sites after the blocks (which was a 90% drop) was a result of the blocks. Next, we note that our regression showed no causal increase in usage of unblocked piracy sites. Thus, for each segment, we calculated the total piracy before the blocks (unblocked plus blocked piracy) and assumed that in the post period, if nothing had changed except for the blocks, it would have been the same number

less 90% of the blocked site visits. From this we calculate the causal change in total piracy for each segment.

Table 3 — Estimated Causal Change in Piracy and Legal Viewing

Pre-block Visits/User to Blocked Sites	Causal Decrease in Total Piracy	Causal Increase in Ad-Supported Viewing	Causal Increase in Subscription Viewing
0	0.0%	0.0%	0.0%
1	7.6%	0.5%	0.4%
2	11.4%	1.0%	0.8%
3	11.1%	1.5%	1.2%
4	13.5%	2.0%	1.6%
5.4	17.0%	2.7%	2.2%
8.3	20.2%	4.2%	3.4%
13.2	22.8%	6.8%	5.4%
23.8	25.3%	12.6%	10.0%
78.6	28.0%	48.1%	36.9%
		(p=0.05)	(p=0.25)

We thus show that our model predicts a larger decrease in piracy and a larger increase in legal viewing when users were heavier users of the blocked sites before the blocks were implemented. In the next section, we estimate the true total increase in legal viewing behavior caused by the blocks and discuss our results in the context of other site blocking actions.

6. Discussion

This study updates our prior study on UK website blocking by examining the largest wave of blocks to date in the UK — 53 piracy websites that were blocked in November 2014. The results from this update yield new insights into the effectiveness of website blocking as well as confirming some explanations we suggested for previous results.

Our results suggest that blocking these 53 sites led to an overall decrease in the total amount of piracy and an increase in consumption of video content through legal sites. To esti-

mate the total impact of the blocks for total piracy, ad supported video viewing, and subscription-based video viewing, we estimate the counterfactual visits to each of these groups of sites for all treated groups and determine the difference between the counterfactual and observed visits in the after period. We then sum these measurements across all treatment groups to determine the total impact on these consumers.

Based on these calculations, we conclude that the blocks caused a 22% reduction in total visits to piracy sites across all treated segments⁸ relative to how much they would have pirated if not for the blocks. This caused a 10% increase in legal viewing at ad-supported sites among the treated segments. It also caused a 6% increase in legal visits to subscription-based sites. Recall that in our analysis of the November 2013 blocks, we only had data on subscription based streaming, and we found that the 2013 blocks caused a 12% increase in subscription based streaming among the treated groups. In November 2014, the increase in subscription based streaming was still positive but only half as large as the increase caused by the 2013 blocks. Against, this lower result could be the result of lower popularity of the 53 sites in 2014 than the 19 sites in 2013, or it could be the result of the increased price sensitivity of the remaining pirates in 2014. In contrast, the 2014 increase in visits to ad-supported streaming was nearly as high as the subscription streaming increase in 2013. This could suggest a more price-sensitive market (since ad-supported sites are free), or it may be that the increase in ad-supported streaming in 2013 was much larger than this since we did not measure ad-supported streaming in the prior study.⁹

⁸ The reason it is not near 100% is because the 53 blocked sites only constituted a portion of the total available piracy sites that we tracked. Moreover, while highly treated segments were heavily reliant on these sites, some of more lightly treated segments relied more on other piracy sites (and all segments made at least some use of the unblocked sites).

⁹ In studying the November 2013 blocks, we did not have data on ad-supported streaming and so we did not measure this increase. It remains possible that the 2014 blocks actually caused similar conversions to legal but that those

Another calculation one might consider would be a conversion ratio: What percentage of the reduced piracy visits resulted in an extra visit to a legal streaming site? We estimate that the blocks caused a reduction of about 25,800 pirate site visits in our sample, while causing 1,350 more visits to ad-supported sites and 925 more visits to subscription based sites than would have otherwise been observed. This implies a conversion ratio of about 8.8%, that is, about 8.8% of thwarted piracy visits resulted in visits to legal ad-supported or subscription based video sites. However, this should not be interpreted as the percent of pirated downloads that lead to lost sales, for two reasons. First, although we capture visits to nearly all of the major piracy sites, for legal sites we only capture the major ad-supported sites dedicated to long-form (movies and television) content. We do not capture data on some sites that may offer television or movie streaming (such as Youtube, since most of the streaming here is for short-form content), we do not capture legal download purchases or rentals, and we do not capture online and offline physical sales. Thus, the 8.8% would be a lower bound on the percent of pirated downloads that are otherwise lost legal consumption.

Perhaps more importantly, we have noted that the 53 blocks in November 2014 occurred after a number of other major blocking actions in the UK. Thus, the Internet users who remained as pirates at the beginning of these blocks likely are not representative of typical pirates. Rather, they are likely to be individuals who were both capable of and showed a preference for pirating long after many of the most popular and reliable piracy sites had been blocked, which could imply that they are either much more educated about piracy websites or that they have lower willingness-to-pay for legal content. In fact, a commonly referenced ratio for the percentage of pirat-

conversions were concentrated more on ad-supported sites. However, this is unlikely, as legal streaming sites were actually growing in recognition and popularity between 2013 and 2014, and so the most likely situation is that the November 2013 blocks also caused a larger increase in ad-supported streaming than the 2014 blocks, though we cannot be certain of this.

ed downloads that are otherwise would be purchases is 20% from Waldfogel (2006). It is intuitively appealing that our conversion ratio is lower than this, given that we do not track all potential sources of legal consumption and that we are likely examining a community of individuals who are more committed to pirated consumption than other individuals.

From a policy perspective, however, our research suggests that website blocking in the UK can still cause a decrease in total piracy and an increase in legal consumption, although it appears as if additional blocks have diminishing returns, at least in terms of their ability to increase visits to subscription based streaming services. Thus, this research complements the existing knowledge on website blocking, although it remains unclear whether there is some number of blocked sites such that additional blocks will not have an impact, or if there will always be positive returns to additional blocks on legal consumption.

Our research comes with many of the same limitations noted in Danaher et al. (2015), in spite of the fact that the present analysis contains somewhat more nuanced data on legal consumption. One of the main limitations is that we only observe a few types of legal behavior (ad supported streaming and subscription streaming), despite the fact that thwarted pirates may also turn to a la carte purchases, DVD/Blu-Ray purchases, or rentals).

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**Appendix A — List of Piracy Sites (Allowing Access to Pirated Video Content)
Blocked in November 2014**

bittorrent.am

btdigg.org

btloft.com

bts.to

limetorrents.com

nowtorrents.com

picktorrent.com

seedpeer.me

torlock.com

torrentbit.net

torrentdb.li

torrentdownload.ws

torrentexpress.net

torrentfunk.com

torrentproject.com

torrentroom.com

torrents.net

torrentus.eu

torrentz.cd

torrentzap.com

vi torrent.org

watchseries.lt

stream-tv.me

watchserieshd.eu
cucirca.eu
movie25.cm
watchseries.to
iwannawatch.to
warez-bb.org
icefilms.info
Tehparadox.com
heroturko.me
scnsrc.me
rapidmoviez.com
iwatchonline.to
losmovies.com
isohunt.to
torrentz.pro
torrentbutler.eu
iptorrents.com
sumotorrent.sx
torrentday.com
torrenting.com
bitsoup.me
torrentbytes.net
seventorrents.org
torrents.fm
yourbittorrent.com

tormovies.org

demonoid.ph

torrent.cd

vertor.eu

rarbg.com