



## Measuring the Effect of Piracy Website Blocking in Australia on Consumer Behavior: December 2018

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### Summary

Website domain blocking (“site blocking”) is one of a number of methods currently being used in dozens of countries to counter online piracy by targeting sites that providing infringing content. Following the methodology of Danaher et al. (2019), this study utilizes a unique, individual-level panel dataset to measure the impact of the December 20, 2018 site blocking wave in Australia on both pirate and legal viewing behavior. The results point to the general effectiveness of site blocking in the country. The December 2018 site blocking wave in Australia reached a substantial portion of Australian online film and video consumers and represented a significant portion of total piracy traffic for those consumers. For users of sites targeted for blocking, traffic to legal content viewing sites increased by 5% in the post-period following the blocking.

### Introduction

Website domain blocking (“site blocking”) is one of a number of methods currently being used in dozens of countries to counter online piracy by targeting sites that providing infringing content. Once implemented, site blocking is meant to curb the access of individuals within a country to infringing sites, with the ultimate goal of encouraging consumption through accessible, legal sites and services.

Site blocking has drawn academic interest as it becomes a more prominent tool to address online infringement in a number of countries (Danaher et. al. 2019). Researchers have sought to assess the impact of site blocking, both on piracy behavior and on consumption of legal content. Evidence so far suggests that website blocking can be effective in cases where enough sites are

blocked, but is less so when only one site is blocked at a time (Aguiar et al 2018, Danaher et al. 2019).

Following the methodology of Danaher et al. (2019), this study utilizes a unique, individual-level panel dataset to measure the impact of the December 20, 2018 site blocking wave in Australia on both pirate and legal viewing behavior. Although site blocking had been used to combat piracy in Australia for more than a year, the December 2018 wave represented a large step up in the breadth of domains targeted in a single time period. By focusing on the late December 2018 site blocking action, this paper examines the earlier insight that large site blocking efforts are more likely to be effective, while also expanding the number of markets in which site blocking impact on consumption has been measured.

### **Background and Literature Review**

Australian courts have authorized website blocking via DNS blocking since 2016, but efforts by various rightsholders significantly increased the number of sites and associated domains subject to blocking at the end of 2018. In December 2018, 233 domains associated with 99 websites were subject to blocking, the largest single wave of site blocking in the country thus far. We exploit the sudden change in accessibility of this large number of sites to treat the site blocking wave as a natural experiment. We use a difference-in-difference model with a balanced seven-week pre- and post-period surrounding the site blocking action to estimate the impact of site blocking on consumption behavior (both pirate and legal) of those affected by the disruption in piracy site access.

This work relates to several streams of academic literature. First, a number of studies have examined the economic impact of piracy behavior on the music and movie industries (Rob and Waldfogel (2006), Bai and Waldfogel (2009), Danaher et al. (2010), Zentner (2012), Danaher and Smith (2014), Ma et al. (2014), Oberholzer-Gee and Strumpf (2007), Smith and

Telang (2009), McKenzie and Walls (2015)). A second stream of academic literature examines the impact of anti-piracy policies and the overall effectiveness of different forms of anti-piracy policy on curbing infringing behavior and encouraging legal consumption (Dey et al. (2015)). The impact of anti-piracy policy has been examined from both the demand side (Danaher et al. (2014), Adermon and Liang (2014), McKenzie (2017)) and the supply side (Aguilar et al (2018), Danaher and Smith (2014), Danaher, et al (2019)).

### Data and Methods

Website panel company data was used in this study, covering 6,241 individual Australian visitors’ weekly desktop visits to sites over a four month period, from November 2018 to February 2019<sup>1</sup>, which were aggregated into three website categories: December 2018 blocked piracy sites, unblocked piracy sites, and legal content viewing sites.<sup>2</sup> Prior to the December 20, 2018 wave of site blocking, 15% of all individuals in the data visited any blocked domain in any of the seven weeks prior to the blocking, and were thus “treated” by the site blocking action.

A user experiences “treatment” if he or she visited a blocked piracy site at all in the period of time prior to the block under study. If a user did not go to any blocked site in the period studied, but did go to other tracked sites, then they are considered a member of the control group. Table 1 presents descriptive statistics for the treatment and control groups.

Table 1: Average Visits Pre- and Post-Block by Group

	N	Blocked Sites		Unblocked Sites		Legal Sites	
		Pre	Post	Pre	Post	Pre	Post
Treatment Group	946	10.6	4.1	16.4	16.6	6.6	6.7
Control Group	5,295	0.0	0.2	3.6	3.4	4.9	5.0

<sup>1</sup> A disruption in the panel company’s ability to collect desktop traffic data from Chrome browsers in late February 2019 impacted our ability to use certain data weeks to accurately assess trends. These weeks were removed from the data, necessitating a February 10, 2019 data cutoff.

<sup>2</sup> See Appendix B for information on the creation of the unblocked piracy site and legal site lists.

Table 1 makes clear that treatment group users are often likely to be heavier consumers of both legal and pirate content. At this descriptive level, average visitation to unblocked piracy sites and legal consumption sites remained relatively consistent before and after the December 2018 site blocking action for users in the treatment group. Average visitation to blocked sites declined sharply for the treatment group, with visitation to this group of sites was down 61% overall from the pre-period to the post-period. For members of the control group who did not visit any blocked sites in the seven weeks prior to site blocking, visitation to each group of sites remained consistent.

Results from previous site blocking studies has suggested that site blocking is more likely to have a measurable impact in cases where targeted sites represent a significant portion of piracy visitation. Table 2 presents the share of total piracy visitation accounted for by visitation to blocked sites by group in the pre- and post-periods. Blocked site visitation made up a notable portion of total piracy visitation by treatment group users in the pre-period (39%). This proportion fell by 19 percentage points following site blocking in December 2018.

Table 2: Share of Visitation by Group

	Blocked Sites: Share of Total Piracy Visitation	
	Pre	Post
Treatment Group	39%	20%
Control Group	0%	5%

To isolate the causal effect of site blocking on individual user behavior, we use a version of the Danaher et al (2019) user segmentation model to assess the impact of site blocking on individual choices. In order to effectively analyze this data, our model takes the underlying negative binomial distribution for the regression model. The negative binomial distribution allows for the use of untransformed count variables as the dependent variable and helps correct

for the fact that our data is overdispersed. That is, many individuals do not visit certain types of sites at all, so the overall distribution is skewed towards zero.

For each wave, the following model was used:

$$Visits_{it} = \beta_0 + \beta_1 After + \beta_2 TreatmentIntensity_i * After + \mu_i + e_{itw}$$

The main explanatory measure is Treatment Intensity, which captures the level of engagement by a user with blocked websites. Treatment Intensity is measured as the sum of visits to blocked sites in the pre-block period.  $Visits_{it}$  is the number of visits by individual  $i$  to a given type of site  $t$  (unblocked piracy, legal, SVOD).  $\beta_0$  is intercept.  $\beta_1$  is the effect of *After*, a dummy equal to 1 after site blocking and 0 before.  $\beta_2$ , the effect of the interaction of *After* and  $TreatmentIntensity_i$ , is the variable of interest.  $TreatmentIntensity_i$  is the sum of visits by individual  $i$  to blocked sites in the pre-period of the wave of blocking under study. The vector of individual-level effects is captured by  $\mu_i$ . Finally,  $e_{it}$  is the unobserved error term.

## Results

Table 3 below presents results from the individual-level model of the impact of the December 2018 site blocking wave in Australia on visitation to unblocked piracy sites and legal consumption sites.

Table 3: Estimated Impact of December 2018 Site Blocks on User Visits

Dependent variable	<b>Unblocked pirate sites</b>	<b>All legal consumption sites</b>
After Block	-0.076* (0.030)	0.012 (0.027)
<i>TreatmentIntensity*After Block</i>	0.010*** (0.002)	0.005* (0.002)
Constant	-0.528*** (0.040)	0.003 (0.031)
Individuals	6,241	6,241
Observations	12,482	12,482
Log Likelihood	2747.2	2593.7

\*\*\*p<0.001, \*\*p<0.01, \*p<0.1. Standard errors in parentheses.

Again, the variable of interest in the coefficient on *TreatmentIntensity\*After*, which is meant to capture the effect of the level of pre-blocking use of the blocked sites. As expected, the coefficient for unblocked piracy is positive and significant, suggesting that users who were no longer able to access piracy sites subject to blocking moved to other, unblocked pirate sites in search of content.

If site blocking is an effective strategy, stakeholders will expect that reducing the number of available piracy content sites will encourage at least some pirates to move content viewing to available legal sites. In the model with legal site visitation as the dependent variable, the coefficient of interest is again positive and statistically significant; meaning that visitation to blocked sites prior to site blocking action is associated with increased visitation to legal content sites in the period after blocking.

In addition to the results of the model, we also calculate the causal effects of site blocking as a percent change in visitation. Negative binominal regressions take a log format which allows for the calculation of change in terms of percentages. As  $\beta_2$  is the variable of interest, we will calculate the effects of Treatment Intensity on user behavior using the follow equation:

$$\Delta \text{ in behavior } (\%) = [(e^{\beta_2 \text{TreatmentIntensity}_i}) - 1] * 100$$

Individual level data allows us to examine the effect of strength of treatment, or how much or little a user frequented blocked sites before site blocking waves. In order to analyze the effect of the strength of treatment, treatment group members were coded as divided into quartiles of users depending on their level of pre-block visitation to blocked sites. The quartiles are equally sized portions of the treatment group based on users' Treatment Intensity, or number of visits to blocked sites in the pre-period. Table 4 displays the calculated causal effects on traffic

to unblocked sites and legal sites for the average number of visits to blocked sites in the pre-period by users in the treatment group, and at different levels of treatment.

Table 4: Causal Effects

	<b>Average Visits</b>	<b>Unblocked sites*</b>	<b>Legal sites*</b>
Top quartile users	33.6	+39%	+17%
2 <sup>nd</sup> quartile	6.0	+6%	+3%
3 <sup>rd</sup> quartile	2.0	+2%	+1%
Bottom quartile users	1.0	+1%	0%
Overall	10.6	+11%	+5%

\* Coefficient used to calculate is significant at the 90% or above confidence interval

Overall site blocking also caused a statistically significant 5% increase in visitation to legal sites and an 11% increase in visitation to unblocked piracy sites. The changes in both total legal site visitation and visitation to unblocked piracy sites at the overall level appear to be driven by shifts in visitation by the heaviest users of blocked sites. The top quartiles of users measured a 39% increase in unblocked piracy visitation caused by site blocking, along with a 17% increase in legal site visitation. Changes in visitation were less pronounced for less heavy users of the blocked sites. These users did not need to compensate for as much viewing behavior and therefore saw smaller shifts to other site options, both legal and pirate.

## **Discussion**

In line with previous site blocking research, the results point to the general effectiveness of site blocking in Australia. The December 2018 site blocking wave in Australia reached a substantial portion of Australian online film and video consumers and represented a significant portion of total piracy traffic for those consumers. Affected users increased consumption of content on legal viewing sites in the post-period following the blocking by 5%. These results

substantiate the findings of earlier research regarding the importance of the size of the site blocking wave in determining its likelihood of impact.



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## Appendix A: Sites Blocked in Australia in December 2018

0123movies.com	azmaple.com	gomovieshd.is
0123movies.is	baywatch.workisboring.com	gomovieshd.se
0123movieshd.com	bilutv.com	gomovieshub.io
123movies.al	bilutv.net	gostream.sc
123movies.cafe	bittorrentstart.com	hdpopcorns.com
123movies.com	bt-scene.cc	hdpopcorns.co
123movies.md	btscene.com	hindilinks4u.net
123movies.net	btscene2.com	hindilinks4u.to
123movies.solar	btscene.cc	hkdramanow.pro
123movies.st	btsproxy.com	hkfree.co
123movies.tf	btstor.com	icdrama.se
123movies.unblockall.org	cartooncrazy.net	icdramase.net
123movies4.com	cmovieshd.net	ilovehks.com
123movies4u.biz	couchtuner.cloud	ipt.af
123moviesc.me	couchtuner.rocks	ipt.beelyrics.net
123moviesfree.com	couchtuner.video	ipt.findnemo.net
123moviesfull.me	dailytvfix.com	ipt.getcrazy.me
123movieshd.sc	ddlvalley.me	ipt.read-books.org
123movieshub.it	dnvod.tv	ipt.rocks
123movieshub.se	dramacity.io	ipt.serve2p.com
123moviestar.net	dramahk.me	ipt.venom.global
2ddl.io	ecouchtuner.eu	ipt.workisboring.net
2ddl.ws	extratorrent.si	iptorrents.com
8maple.ru	eztv.unblocked.gdn	iptorrents.eu
9anime.is	ffmovies.ru	iptorrents.me
9anime.ru	fmovies.cloud	iptorrents.ru
9anime.su	fmovies.io	iptorrents.us
9anime.to	fmovies.pe	ipt-update.com
addic7ed.com	fmovies.unblocked.gdn	ixftv.com
alien.eating-organic.net	freeputlockers.org	kantv.im
anilinkz.com	ghost.cable-modem.org	kimcartoon.me
anilinkz.to	glodls.to	kimcartoon.to
animefreak.tv	gogoanime.in	kissanime.ac
animeonlinehere.net	gogoanime.io	kiss-anime.me
animeseries.co	gogoanime.se	kissanime.to
animeshow.tv	gogoanime.tv	kiss-anime.tv
animestreams.tv	gogoanimemobile.net	kisscartoon.ac
animetv.to	gogoanimes.co	kissanime.ru
asianvote.com	gomovies.ag	kong.net-freaks.com
avaxhome.unblocker.xyz	gomovies.as	limetorrents.asia
avxhm.is	gomovies.ec	limetorrents.info
avxhm.se	gomovies.film	logan.unusualperson.com
azasianow.com	gomovies.ist	m4ufree.com
azdrama.io	gomovies.sc	masterani.me

myanimseries.com	td.beelyrics.net	watchseries.ws
nyaa.si	td.findnemo.net	watchseries-online.be
nzbplanet.net	td.getcrazy.me	woaikanxi.cc
ondarewatch.com	td.net-freaks.com	woaikanxi.com
openloadmovies.net	td.read-books.org	woaikanxi.net
openloadmovies.tv	td.servep2p.com	xmovies8.pl
opensubtitles.org	td.unusualperson.com	xsava.xyz
otakustream.tv	td.venom.global	yify.bz
phimbathu.com	td.workisboring.com	yify-movies.net
putlocker.ac	td.workisboring.net	yifysubtitles.com
putlocker.to	the123movies.com	ymovies.tv
putlockerhd.co	the123movies.org	zimuzu.tv
putlockers.gs	torrentday.com	zoogle.com
putlockers.plus	torrentfunk.com	
putlockers.tv.ac	torrentmovies.co	
qooxi.net	tubeplus.ag	
rapidmoviez.com	tubeplus.me	
rapu.live	tvbox.ag	
rapu.rocks	tvmaple.com	
rapu.world	tw116.com	
rarbgrpx.org	twomovies.biz	
rmz.cr	twomovies.info	
rutracker.org	two-movies.me	
scenesource.me	two-movies.name	
scenesource.net	two-movies.net	
scnsrc.me	twomovies.tv	
scnsrc.net	twomovies.us	
seasonvar.ru	ultraavid.ca	
seriesfree.to	ultra-vid.com	
soek.in	usabit.com	
soek.pw	vexmovies.org	
soek.site	viewasian.tv	
solarmovie.sc	vioozgo.org	
solarmoviez.ru	vkool.net	
solarmoviez.to	vmovee.me	
soul-anime.ch	vmovee.ws	
soul-anime.us	vmovee.xyz	
streamtvb.com	watchanimesonline.io	
subscene.com	watchcartoononline.com	
subsmovies.com	watchcartoononline.io	
subsmovies.me	watchonlinemovies.com.pk	
subsmovies.nl	watch-series.co	
subsmovies.nz	watchseries.fi	
subsmovies.tv	watchseries.si	

## **Appendix B: Creation of Unblocked Piracy and Legal Site Lists**

The list of sites blocked in December 2018 in Australia was derived from the associated court orders. We also created lists of legal and unblocked infringing sites to provide to the panel tracking company. Legal sites were collected based on Internet research, including the listing found at <https://www.justwatch.com/au>. Additional legal services were found in consultation with Australia film and television industry contacts.

Infringing websites are harder to capture. Our unblocked piracy site list was created in consultation with piracy experts who relied on sources including:

- A list of copyright infringing sites developed by Incopro<sup>3</sup>
- Sites listed on the Google Transparency Report with over 10,000 removal requests due to copyright infringement as of May 2019.

We included all sites with infringing film/TV content, while excluding sites with only adult, music, games, user generated content (UGC), or eBook content. A list of 1,851 unblocked infringing sites was sent to the panel tracking company, which returned visitation data for 810 of these sites.

After analysis was completed, we learned of a popular unblocked piracy site, 123movies.la, which was not captured by these efforts, but was large enough to affect trends during the December 2018 blocking wave. This omission may affect estimated in the unblocked piracy model, but has no effect on the legal model. Also, the unblocked piracy model estimates remain unbiased as long as piracy site users were equally likely to visit the omitted site as the sites included in the data.

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<sup>3</sup> See <https://www.incoproip.com/reports/site-blocking-efficacy-key-findings-australia>