

An Impotent Aegis:

*An economic analysis of the effectiveness
of Australia's anti-circumvention laws*

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Abstract

This paper examines the degree to which anti-circumvention laws meet their policy objectives of reducing piracy and protecting copyright owners' interests. This paper develops economic models of 'rational contravention' and applies them to Australian anti-circumvention laws. These models are used to analyse the impact that the laws have on potential contraveners, and the extent to which these parties may be dissuaded from engaging in their illegal activities. The results indicate that Australian anti-circumvention laws will not deter a substantial number of contraveners, nor significantly improve copyright owner protection.

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1 INTRODUCTION

[1.1] Introduction

While the legal academic discussion of anti-circumvention law has hastened to revolve around policy and legal doctrine, there has been no research into whether the laws will actually change the behaviour of citizens, and consequently meet their objectives.¹ This is not surprising, as the discipline of law does not provide a means of predicting behaviour.

This paper, however, presents an economic perspective on how anti-circumvention laws will work, in reality. Certainly, there are many grave concerns with the ever-expanding scope of copyright protection, but the real-world effectiveness of anti-circumvention law is often neglected in the debate.²

¹ See section 1.2.1 at page 9 below.

² Ibid.

In the words of David Lindsay:³

proposals for legal change should be predicated upon a clear identification of the public policy objectives sought to be achieved by such proposed changes and the extent to which the change may or may not promote such objectives.

This paper, therefore, applies economic models and analyses to evaluate the degree to which Australian anti-circumvention laws meet their 'policy objectives', and thus the degree to which they are justified. Of course, economics does not tell the whole story, but it can give some objective insight and contribute to the literature.⁴

This paper argues that, although these laws are not conceptually flawed, their application in Australia will not reduce the levels of circumvention and copying significantly.

³ Lindsay D, *The Economics and Law of Copyright, Contract and Mass Market Licences* (Sydney: Centre for Copyright Studies, 2002b), at 3:
<http://www.copyright.com.au/reports%20&%20papers/IssuesPaper_Lindsay.pdf> (26 Jul 2007).

⁴ Economic models cannot consider the intricacies of the drafting process, and their verisimilitude will always be limited by the standard economic assumptions that they operation upon. There are also some factors affecting the creation of laws that cannot be monetised, and are thus considered unimportant in economic analyses. This illustrates why economics is a tool for analysis rather than a tool for recommendation. Economics gives the evidence, and fuels the debate, but policy decisions must still be made with reference to issues that are above and beyond economic models.

[1.2] The State of Knowledge

[1.2.1] *Legal Analyses*

There have been three approaches to the study of Australian anti-circumvention laws.

The first approach has focused on the formation of the laws. There is some concern over the imbalanced negotiation of the Australia-United States Free Trade Agreement (AUSFTA), which required reforms to Australian law.⁵ For example, Catherine Bond, Abi Paramaguru and Graham Greenleaf believe that this led to the hasty introduction of unduly harsh anti-circumvention laws, without adequate community input.⁶

Second, there has been considerable analysis of the legal doctrinal basis of anti-circumvention laws, and the degree to which they are consistent with the

⁵ Brian Fitzgerald has expressed concern that Australia has been forced into accepting extreme US restrictions, without appreciating the liberating US fair use allowance. Mary Wyburn has also argued that a fair use provision may add confusion and uncertainty in the short-term, but it could also allow the courts to address long-term issues that copyright owners and the higher education sector have had with fair dealing allowances. See, Fitzgerald B, 'Technological Protection Measures' *Copyright Vision: Copyright Jails* 26 Oct 2006 <<http://www.onlineopinion.com.au/view.asp?article=5068>> (26 Sep 2007); Wyburn M, 'High Education and Fair Use: A Wider Copyright Defence in the Face of the Australia-United States Free Trade Agreement' (2006) 17 *AIPJ* 181.

⁶ Bond C, Paramaguru A & Greenleaf G, 'Advance Australia Fair? The Copyright Reform Process' (2007) 10 *Journal of World Intellectual Property* 284.

legal principles underlying copyright.⁷ The views of Kimberlee Weatherall and Brian Fitzgerald are representative of this type of approach. They criticise the degree of compromise involved in the creation of Australia's anti-circumvention laws, and condemn the way the new laws have expanded beyond the traditional protection of copyright.⁸

Third, there have been numerous studies into the oppressive effects of anti-circumvention laws on consumer rights, especially those of fair dealing. Melissa De Zwart has argued that the anti-circumvention legislation requires more exceptions and defences, to protect the balance of power between copyright owners and consumers.⁹ David Brennan, however, has cautioned against the implementation of such further exceptions. He believes that extending consumer rights in the digital environment could void copyright altogether.¹⁰ Indeed, David Lindsay has even argued that no rebalancing of power is necessary, as the issues of 'digital lock-up' raised by other academics have been overstated.¹¹

⁷ European academics have also reviewed the loss of consumer rights caused by TPM protection. See, for example, Koelman K, 'A Hard Nut to Crack: The Protection of Technological Measures' (2000) 22 *EIPR* 272, at 277, 273-274.

⁸ Weatherall K, 'On Technology Locks and the Proper Scope of Digital Copyright Laws: Sony in the High Court' (2004b) 26 *SydLR* 613, at 626-632; Fitzgerald, above, note 5. See also, De Zwart M, 'Technological enclosure of copyright: The end of fair dealing?' (2007) 18 *AIPJ* 7, at 8-14.

⁹ De Zwart, above, note 8.

¹⁰ Brennan D, 'Technological Measures in the New Copyright Law' (2000) 11 *AIPJ* 83.

¹¹ Lindsay D, 'A Comparative Analysis of the Law Relating to Technological Protection Measures' (2002a) 20 *Copyright Reporter* 118. Moreover, the House of Representatives Standing Committee on Legal and Constitutional Affairs has conducted an extensive, all-

There has been some discussion of enforceability issues; most recently by Christopher Kendall and Lisa McNamara; however, this has been limited to traditional copyright, and has not considered the practicality of enforcing anti-circumvention laws.¹²

So, while there has been rigorous criticism of the policy of Australian anti-circumvention laws, and the negative impact they have on the rights of copyright users, there has been no discussion of their effectiveness in reality.

[1.2.2] *Economic Analyses*

This paper draws upon two distinct bodies of economic literature: those that study copying behaviour and those that analyse the decisions of rational law-breakers.¹³

Academics like William Johnson, Lisa Takeyama, Fabrice Rochelandet and Fabrice LeGuel have developed economic models to predict copying behaviour in individuals and markets; each focusing on the variables and

encompassing anti-circumvention law review, which investigated all three of the above concerns. See, Standing Committee on Legal and Constitutional Affairs, *Review of technological protection measures exceptions* (Canberra: Parliamentary Library, 2006), at 8: <<http://www.aph.gov.au/house/committee/laca/protection/report/fullreport.pdf>> (26 May 2006).

¹² Kendall C & McNamara L 'Piracy and the Copyright Act: Criminal Deterrent or "Slap on the Wrist"?' (2002) 13 *AIPJ* 121.

¹³ These studies and findings are explained in detail throughout chapter 2.

externalities that they believe are most prevalent.¹⁴ Using the theory of demand, and some empirical research, these academics have developed accurate, predictive models, which give insight into infringer costs and motivations. These studies are explained in more detail in chapter 2.

Additionally, since Gary Becker revamped the theory of rational contravention in 1968, there has been considerable economic study into the motivations of individuals who undertake unlawful activities, and the theories of enforcement and deterrence.¹⁵ Many academics, including Ehrlich, Kolm, Heineke, Schmidt and Witte, have taken Becker's lead and have crafted economic models which can be used to understand and predict the behaviour of law-breakers.¹⁶ These models have been applied to many types of unlawful

¹⁴ Johnson W, 'The Economics of Copying' (1985) 93 *JPolitEconomy* 158, at 162-164, 168; Takeyama L, 'The Welfare Implications of Unauthorized Reproduction of Intellectual Property in the Presence of Demand Network Externalities' (1994) 42 *The Journal of Industrial Economics* 155, at 159; Rochelandet F & LeGuel F, *P2P Music-Sharing Networks: Why the Legal Fight Against Copiers May be Inefficient* (Paris: Social Science Research Network, 2005), at 4: <<http://ssrn.com/abstract=810124>> (2 Jul 2007).

¹⁵ Becker G, 'Crime and Punishment: An Economic Approach' (1968) 76 *JPolitEconomy* 169.

¹⁶ Ehrlich I, 'Participation in Illegitimate Activities: A Theoretical and Empirical Investigation' (1973) 81 *JPolitEconomy* 521; Kolm SC, 'A Note on Optimal Tax Evasion' (1973) 2 *Journal of Public Economics* 265; Heineke, above, note 16; Schmidt P & Witte AD, *An Economic Analysis of Crime and Justice: Theory, Methods, and Applications* (New York: Academic Press, 1984). For a comprehensive analysis of all of the major studies in this field, see Eide E, 'Economics of Criminal Behaviour' in Bouckaert B & De Geest G, eds, *Encyclopaedia of Law and Economics* [Volume V: The Economics of Crime and Litigation] (Cheltenham: Edward Elgar, 2000) 345, at 345-6, 350.

activity, from murder to tax evasion,¹⁷ but the economic academia are yet to apply the models to anti-circumvention laws.¹⁸

[1.2.3] *The Combination*

This paper contributes to both the legal and economic bodies of knowledge, by assessing, from an economic perspective, the degree to which Australian anti-circumvention laws meet their policy objectives. It achieves this by building upon the existing economic analyses of copying and contravention, and extending them to apply to Australian anti-circumvention laws.

[1.3] Basic Terminology

Integral to the analyses of this paper are the terms digital rights management (DRM) and technological protection measure (TPM).

Digital Rights Management (DRM) is a broad term used to describe the use of digital technologies to protect intellectual property rights.¹⁹ Technological

¹⁷ For example, murder is considered in Ehrlich, above, note 16, and tax evasion is considered in Kolm, above, note 16.

¹⁸ John Rothchild investigated, in 'Economic Analysis of Technological Protection Measures' (2005) 84 *OrLR* 489, the economic benefits that copyright owners can reap by implementing TPMs, and the most efficient manner of doing so. However, he engages in no discussion of anti-circumvention laws or their effectiveness.

Protection Measures (TPMs), on the other hand, may be specific elements in a DRM scheme.²⁰ The concept of a TPM is a construct of the legislation, and the definition used by the *Copyright Act 1968* (Cth) (the Act) demarcates those methods of digital content protection that attract legal protection, from those that do not.

There are two distinct kinds of TPM under the copyright law in Australia. This paper will refer to them as access control technological protection measures and copy control technological protection measures. This distinction is grounded in the two definitions used in s 10 of the Act.

According to s 10, an access control TPM is a 'device, product, technology or component (including a computer program) that...is used...in connection with the exercise of...copyright; and...controls access to the [copyright] work'. These TPMs often take the form of encryption systems that forbid access until an authorised private key or password is detected.²¹

¹⁹ Rosenblatt B, Trippe B & Mooney S, *Digital Rights Management: Business and Technology* (New York: M&T Books, 2002), at vii.

²⁰ Note that a DRM system will not necessarily contain 'TPMs' as they are defined under the copyright legislation. For example, the Windows Genuine Advantage DRM scheme, also known as the Software Verification or Authentication Tool, restricts some Windows update functionality, if an original version of Windows XP cannot be found. This allows Microsoft to inform Windows users that they may have been sold an illegal copy, and to frustrate, to some extent, the use of pirated software. This is an effective DRM scheme, however it does not limit the user's ability to copy, modify or access Windows, so its mechanisms will not be considered TPMs.

²¹ Standing Committee on Legal and Constitutional Affairs, above, note 11, at 8.

The second type of TPM, the copy control TPM, is defined under 'technological protection measure' in s 10 of the Act, as 'a device, product, technology or component (including a computer program) that...is used...by...the owner or the exclusive licensee of the copyright in a work...and... prevents, inhibits or restricts the doing of an act comprised in the copyright'.²² These acts extend to reproduction, format-shifting and adaptation of the work.²³

For the purposes of this paper, the term TPM shall include both kinds, to be consistent with the s 10 definition. Access control TPMs and copy control TPMs will be differentiated clearly to the reader where necessary. This paper also limits its analysis to TPMs that legitimately protect copyright, and excludes those which are designed only to enforce marketing schemes.²⁴ This is discussed further, below.²⁵

²² There is no legislative title for the 'copy control' TPM. This term is only used to make clear distinctions in this paper. Under s 10, a copy control TPM is simply any TPM that is not an access control TPM.

²³ These are the major exclusive rights granted to the copyright owner under s 31(1).

²⁴ These schemes do exist, and some copyright owners have attempted to rely on anti-circumvention laws to protect these schemes. This occurred in the US case of *Lexmark International Inc v Static Control Components Inc* 387 F 3d 522 (DCt 2004). See, De Zwart, above, note 8, at 37.

²⁵ See section 1.5 at page 24.

[1.4] The Value of TPMs

[1.4.1] *Digital Replicability*

From an economic perspective, copyright hinders the market's efficiency and production, and it inhibits the dissemination of information and works that would otherwise benefit society.²⁶ But society must guarantee creators some rewards, to induce them to produce and release their works. This guarantee becomes harder to make when digital content is involved, as advances in technology have allowed copyright infringement on a mass scale; not by few, as was traditionally the case, but by many.²⁷

Digital material can be copied an infinite number of times, with incredible ease, and with little to no degradation in quality.²⁸ This makes unauthorised

²⁶ Loughlan P, *Intellectual Property: Creative and Marketing Rights* (Sydney: LBC Information Services, 1998), at 16.

²⁷ Copyright owners enjoy substantial control in traditional formats, due to the inherent physical nature of the medium used. For example, in a cinema you must pay for your ticket to see the movie once, in the location and at the time dictated. Similarly, art galleries will allow you to view a painting for a set fee, after which you must leave the premises. While these controls are powerful, and at times binding in contract, they are not enforced by intrinsic law. This degree of inherent control is not possible with distributed digital content, unless TPMs are applied and are protected from circumvention. See, De Zwart, above, note 8, at 9; Rosenblatt, Trippe & Mooney, above, note 19, at vii.

²⁸ For example, a Microsoft Office document may be replicated, modified and format-shifted with great speed and ease. Compare this with the Mona Lisa, or a hard copy version of the complete works of Charles Dickens. The Mona Lisa has intricate detail that may never be mimicked perfectly, and even a good attempt would take many days. The complete works of Charles Dickens would comprise such a volume of material, that to replicate it in perfect form it would take a single man with a word processor many weeks

copying far more attractive, as quality is retained; and much easier, as it can be achieved at the touch of a button.

It is argued that this improved replicability makes releasing content online, or even in digital form, very risky for copyright owners.²⁹ TPMs try to reduce this risk by limiting user freedoms with regard to data; most importantly, the ability to copy or use it without authorisation.

[1.4.2] Does Consumer-Level Private Piracy Really Damage Copyright Owner Interests?

While copyright owners have argued that they suffer considerable loss due to consumer-level private piracy, the legal community has contested these claims, as being largely unsubstantiated.³⁰

There is an intuitive argument that, if consumers can unlawfully acquire a copyright product for free, at least some who would otherwise buy legally

of hard, menial work. On the other hand, the digital version of this compilation in the Microsoft Word document format, could be copied perfectly, with a humble home computer, in less than a second, and distributed to hundreds of people around the world in less than an hour.

²⁹ See note 33 below.

³⁰ De Zwart, above, note 8, at 9.

would choose the illegal option. There is, however, limited evidence that this is true.³¹

There is some empirical research that suggests that, at least in the music industry, piracy has a negative effect on the levels of legitimate sales.³² Unlike most 'investigations' into copyright owner loss, however, these empirical studies into pirated music reveal that the ratio of pirated copy to lost sale is not one to one.³³ Results vary on the specifics of this ratio, however there is evidence that between three and five copied products will translate to one lost sale.³⁴

³¹ Ibid.

³² Rob R & Waldfogel J, 'Piracy on the High Cs: Music Downloading, Sales Displacement, and Social Welfare in a Sample of College Students' (2006) 49 *JLEcon* 29; Zentner A, 'Measuring the Effect of File Sharing on Music Purchases' (2006) 49 *JLEcon* 63; Hong S, *The Effect of Napster on Recorded Music Sales: Evidence from the Consumer Expenditure Survey* (Stanford: Stanford Institute for Economic Policy Research, 2004): <<http://siepr.stanford.edu/Papers/pdf/03-18.pdf>> (26 Jul 2007); Blackburn D, *On-line Piracy and Recorded Music Sales* (Harvard: Harvard University, 2004): <http://www.katallaxi.se/grejer/blackburn/blackburn_fs.pdf> (26 Jul 2007); Peitz M & Waelbrock P, 'The Effect of Internet Piracy on Music Sales: Cross-Section Evidence' (2004) 1 *Review of Economic Research on Copyright Issues* 71.

³³ Consider the investigation conducted by the Allen Consulting Group, which found that pirated material accounts for about 19 per cent, or \$100 million, of the Australian computer and video game market. The study proceeded to conclude that this is how much copyright owners lose annually. But just because there are this many pirated copies in existence, it does not mean that every copy replaces one sale, and it certainly does not mean that the copyright owner suffers a loss of the whole original price of one unit. See, Van Wijk, above, note 42, at 689; Standing Committee on Legal and Constitutional Affairs, above, note 11, at 33.

³⁴ Rob and Waldfogel found that one downloaded music album results in 0.2 fewer purchases, while Zentner found that peer-to-peer downloading reduces a user's probability of purchasing legally by 30 per cent. Some studies have not considered the effect per individual, but rather have considered how far piracy is responsible for the serious decline in music sales since 2000. Hong suggests that piracy was responsible for one third of the reduction, while Blackburn found that a 30 per cent reduction in the number of illegal music files available would have resulted in a 10 per cent sales increase

These results may not apply to other intellectual property industries, to the same extent, but the intuitive substitutability argument is still validated by these findings.³⁵ Even though the conversion rate may not be one for one, pirated copies may still satisfy the demand of consumers who would otherwise have bought original versions. This indicates that, by hindering piracy, effective TPMs can support copyright owners' financial interests.

[1.4.3] *More Material in the Digital Marketplace*

By protecting copyright owners' interests, TPMs may allow more material into the digital marketplace.³⁶ Copyright owners argue that they could be robbed of their rewards in the digital environment. They may consequently choose to restrain technological development by refusing to release their products in emerging formats.³⁷ Effective TPMs, however, can make unauthorised copying and access far more difficult. This may consequently

in 2003. Also, Peitz and Waelbrock, in a less reliable study, found that music downloading could have been responsible for 20 per cent of the drop in music sales. See, Rob & Waldfogel, above, note 32; Zentner, above, note 31; Hong, above, note 32; Blackburn, above, note 32; Peitz & Waelbrock, above, note 32.

³⁵ Logically, one could conclude that if people want to buy something, but can get it for free; then the free unit will substitute for the legally purchased one.

³⁶ De Zwart, above, note 8, at 9. Note however that, while this theory is wholly true for online content, it is difficult to justify it when it comes to DVDs, CDs and other physical media. It hardly seems likely that the big entertainment companies would switch back to analogue cassette tapes, just to stop the copyright pirates.

³⁷ Big media companies have previously smothered new and improved technologies, to protect their revenue streams. See, Lessig L, *Free Culture: How big media uses technology and the law to lock down culture and control creativity* (New York: Penguin Press, 2004), at 5.

persuade copyright owners to release their works into the digital marketplace.³⁸

For example, some software-providers now offer sample software, as a trial version, so users may test the program and ensure it suits their needs. The program will include an access control TPM which limits operation to 30 days, or reduces functionality until a serial code is purchased from the software distributor.³⁹ If the TPMs in such schemes were not effective, users could use the software they trialled, indefinitely, without rewarding the creator.

[1.4.4] *Effective TPMs Hindering Piracy*

By definition, effective TPMs do hinder the unauthorised copying of and access to copyright material.⁴⁰ Copy control TPMs inhibit illegal reproduction, and access control TPMs may prevent the use of illegal copies, thus making their creation fruitless.⁴¹

³⁸ Moreover, TPMs provide the front-line defence necessary to protect digital copyright products, which was not required when the copyright law was initially developed.

³⁹ For example, the AutoCAD program uses the 30 day trial system. See, Autodesk, 'Autodesk – AutoCAD – 30-Day Trial Download' <<http://usa.autodesk.com/adsk/servlet/mform?siteID=123112&id=9106363>> (19 Sep 2007).

⁴⁰ For TPM definitions see section 1.3 at page 13 above.

⁴¹ There are protection measures that do not protect copyright and are simply used to promote marketing schemes. However, as explained earlier, these are not considered TPMs under s 10 and are not considered TPMs for this paper.

However, TPMs will only hinder piracy while they are effective. The unfortunate reality is that, when TPMs hit the hostile environment of the modern digital world, they are often circumvented quickly.⁴²

[1.4.4.1] *TPMs MADE INEFFECTIVE*

Players in the Circumvention Game

There are two types of people who use TPM protected content. Firstly, there are those in the 'inner circle', who have intimate knowledge of the TPM and sufficient technological dexterity to apply their knowledge to circumvent it.⁴³

This group may include highly skilled hackers, academics, computer engineers and programmers.⁴⁴ Secondly, there are those in the 'outer circle' who do not have this knowledge or ability, and thus cannot circumvent the TPM.⁴⁵ This group is primarily made up of average consumers.

⁴² TPMs will always be cracked, eventually. The speed of this depends on the demand for circumvention devices. See, Van Wijk J, 'Dealing with Piracy: Intellectual Asset Management in Music and Software' (2002) 20 *European Management Journal* 689, at 692, 695; Rothchild, above, note 18, at 555; Weatherall (2004b), above, note 8, at 614; Chang YL, 'Does Lessig's Criticism of Digital Rights Management Target One Technology That the Information Industries Desire More Than They can Actually Provide?' (2005) 19 *International Review of Law Computers & Technology* 235, at 248.

⁴³ Van Wijk, above, note 42, at 692.

⁴⁴ Id, at 694.

⁴⁵ Id, at 692.

TPMs are generally aimed at stopping outer-circle, private consumers, from copying.⁴⁶ Large-scale commercial pirates typically have the resources and connections needed to circumvent anyway; so they are merely inconvenienced by TPMs.⁴⁷ The average consumer, on the other hand, has no chance of circumventing effective TPMs, because of the technological complexity of their construction.⁴⁸

Linking the Inner and Outer Circles

Inner-circle participants give the average user the ability to circumvent, by providing their circumvention-enabling knowledge to the outer circle, in usable form.⁴⁹ Inner-circle knowledge is codified into a 'circumvention device', which allows the outer-circle user to circumvent just as well as the inner-circle device creator; without any of the necessary knowledge.⁵⁰

This transmission of circumvention devices has permitted the wide-scale circumvention of TPMs, which has rendered many of them largely

⁴⁶ Van Wijk, above, note 42, at 691; Koelman, above, note 7, at 278.

⁴⁷ Ibid. Even small technological hurdles can stop unsophisticated home users. However, commercial pirates can access inner circle information to circumvent, regardless of TPM strength.

⁴⁸ Van Wijk, above, note 42, at 692.

⁴⁹ Ibid.

⁵⁰ Van Wijk, above, note 42, at 692; Chang, above, note 42, at 237.

ineffective.⁵¹ This is not a problem with the methods used to protect the content. The issue lies in the availability of circumvention devices; as the internet has such a vast global market penetration now, that if one person can circumvent a TPM with a software tool, the whole world can receive that tool in moments.⁵² This quick and complete transfer of inner-circle knowledge often makes TPMs ineffective, and thus unsuccessful at reducing piracy significantly.

So it seems TPMs do hinder piracy, while they are effective. However they are often made ineffective by the wide-scale circumvention allowed by the inner circles' transmission of knowledge to the outer circle.

[1.5] Australian Anti-circumvention Laws Supporting TPMs

The Objective

The objective of anti-circumvention law is to protect copyright owners' interests, by stopping 'piracy'.⁵³ It is widely argued that consumer-level

⁵¹ Van Wijk, above, note 42, at 694.

⁵² Rothchild, above, note 18, at 497.

⁵³ According to the Attorney General, the Department of Foreign Affairs and Trade, the 'General Outline' section of the Explanatory Memorandum (EM) accompanying the Copyright Amendment Bill 2006 and para 197 of the EM accompanying the Copyright

digital piracy is costing copyright owners a great deal, so anti-circumvention laws have been applied to halt these illegal activities.⁵⁴ As TPMs protect copyright owners' rights and anti-circumvention laws protect TPMs, the concept is that, by proxy, anti-circumvention laws will also protect copyright owners' interests.

The Operation

Anti-circumvention laws seek to prevent circumvention, and improve the effectiveness of TPMs, in two ways.

First, the outer-circle circumventers and copiers are hindered directly, by making many circumvention activities illegal.⁵⁵ This introduces a small risk of being punished under the law, and theoretically should reduce the propensity to circumvent and copy.

The Australian anti-circumvention laws set out prohibitions, under ss 116AN and 132APC, that forbid a person from doing 'an act that results in the

Amendment (Digital Agenda) Bill 2000, anti-circumvention laws are aimed at stopping piracy, by protecting TPMs. See, Standing Committee on Legal and Constitutional Affairs, above, note 11, at 12, 15, 20-21.

⁵⁴ There are countless reports from copyright owners and copyright-protective groups that indicate the amount of revenue 'lost' to piracy. For example, see Van Wijk, above, note 42, at 689; Standing Committee on Legal and Constitutional Affairs, above, note 11, at 33.

⁵⁵ Under ss 116AN and 132APC.

circumvention of the access control technological protection measure; and...the person knows, or ought reasonably to know, that the act would have that result'.⁵⁶ This prohibition does not forbid the circumvention of copy control TPMs, and thus ensures that users are not forbidden from exercising their fair dealing rights of reproduction and use,⁵⁷ if they have already been granted access lawfully.⁵⁸

Australia's laws are focused further, by limiting legal protection to TPMs that are connected with the exercise of copyright, and by excluding those that are part of marketing schemes that geographically segment markets.⁵⁹ But, while

⁵⁶ These are the exact words used in s 116AN. Section 132APC provides remedies where a 'person engages in conduct...[that] results in the circumvention of...an access control technological protection measure; and...the person engages in the conduct with the intention of obtaining a commercial advantage or profit'.

⁵⁷ The EM accompanying the Copyright Amendment Bill 2006 states, at paras 12.43 and 12.114, that the circumvention prohibition did not extend to copy control TPMs, simply because this was not required by the AUSFTA. However, given the many references to US cases in the EM, it seems probable that the comments of Kaplan J in *Universal Studios v Reimerdes* 82 F Supp 2d 211 (Dist Ct NY 2000), would have been considered in the drafting process. Kaplan J justified the limitation of the US circumvention prohibition to access control TPMs only, as it allows some preservation the US 'fair use' consumer rights. See, Lindsay (2002a), above, note 11, at 132.

⁵⁸ For example, a journal database will have access control TPMs blocking the access of all non-subscribers. Circumventing this TPM, and accessing the works without authorisation, would be tantamount to illegally copying the journals at a newsstand without paying. However, if a legitimate member accesses the journals and wants to reproduce a part of them for educational purposes, any copy-control TPMs may be legally circumvented to accomplish this. This does not solve the problem for TPMs which control both access and copying, and it places the onus of acquiring a circumvention device upon the circumventer. So the laws are still not perfectly focused. See, Lindsay (2002a), above, note 11, at 132.

⁵⁹ See the s 10(1) definition of access control TPM, at para (c), and the definition of TPM, at para (b)(iii). This geographical segmentation exclusion currently only applies to cinematograph films and computer programs and games, as these are the only Australian copyright products which use such schemes. If other industries begin using this type of marketing TPM widely, s 10 will likely be amended to exclude them also.

these laws are noticeably restricted, they clearly take the first step of attacking circumventers directly.

The second step is directed at preventing the transfer of circumvention-enabling knowledge from the inner circle to the outer circle, in order to increase the difficulty of circumventing and copying.⁶⁰ This prohibition is effected by ss 116AO and 132APD, which prohibit the manufacture, importation, sale and distribution of circumvention devices; and by ss 116AP and 132APE, which forbid the provision of circumvention services.⁶¹

Providers of circumvention devices and services need to be punished to break the inner to outer circle communication that allows widespread circumvention and piracy. So, even though dealers do not necessarily circumvent TPMs or infringe traditional copyright themselves,⁶² their distribution of circumvention devices can allow many outer circle individuals to circumvent and copy, where they could not before.

⁶⁰ The s 10 definitions of 'circumvention device' and 'circumvention service' extend to both access control and copy control TPMs. So both types will appreciate some barrier against the inner to outer circle knowledge transfer.

⁶¹ Both the device and service provider prohibitions require that the provider 'knows, or ought reasonably to know, that the device is a circumvention device'. Additionally, for the criminal sanctions of ss 132APD and 132APE to apply, individuals must provide 'with the intention of obtaining a commercial advantage or profit'.

⁶² For example, a provider who simply sells a circumvention dongle, which allows the use of infringing software copies, will not circumvent a TPM. This sale breaches ss 116AP and 132APE of the Act, but does not constitute a circumvention.

As Australia's anti-circumvention laws clearly address the problem of TPM circumvention on these two fronts; their deterrent effect on both users and providers will be considered in the following economic analysis.

2 THE MODELS

[2.1] Economics Introduction

Traditionally, economics is applied to evaluate the Pareto or Kaldor-Hicks efficiency of laws, ideas or scenarios.⁶³ However, economic efficiency does not necessarily make a law good for society; so this paper will not rate anti-circumvention laws based on Pareto or Kaldor-Hicks efficiency. Instead, it will evaluate the effectiveness of the laws at meeting their objectives of reducing circumvention, and consequently protecting copyright owner interests.

As explained earlier, anti-circumvention laws are only effective at reducing piracy when they improve the efficacy of TPMs.⁶⁴ With this point accepted, the effectiveness of anti-circumvention laws can be established by evaluating, in economic terms, the extent to which they reduce the 'utility', or net benefit, of circumventing TPMs. This investigation will, however, also analyse the

⁶³ Pareto efficiency is achieved when no parties involved are worse off after the given change has been made. While Kaldor-Hicks efficiency can be attained if one party gains more than the others lose, such that there is an increase in the total net benefits appreciated. See, Allen Consulting Group, *Economic Perspectives on Copyright Law* (Sydney: Centre for Copyright Studies, 2003), at 9: <<http://www.copyright.com.au/reports%20&%20papers/CCS0203Thorpe.pdf>> (27 Jul 2007); Garoupa N, *An Economic Analysis of Criminal Law* (Portugal: Universidade Nova de Lisboa, 2003), at 3.

⁶⁴ See section 1.5 at page 23 above.

anti-circumvention laws' effects on the 'utility' of providing circumvention devices and services, as the laws attempt to reduce both the use and the supply of circumventive capability.

In the absence of concrete empirical evidence on anti-circumvention laws in Australia, effectiveness will be determined using the economic models of copying and contravention. These economic models are based on rational contravention theory, which was first posited by Jeremy Bentham in the early 19th century,⁶⁵ but was modernised by Gary Becker in 1968.⁶⁶ Becker developed predictive models which were driven by the notion that individuals contravene laws in order to apply their scarce resources in the most efficient manner, and thus maximise their utility.⁶⁷

This Beckerian framework provides a base that can be used to consider the economics of copying and circumvention,⁶⁸ by assessing the costs and benefits relating to any party's act of contravention. Anti-circumvention laws must increase the 'costs' of using and disseminating circumvention devices, if they

⁶⁵ Bentham J, 'The Principles of Penal Law' in Bowring J, ed, *The Works of Jeremy Bentham Volume I* (New York: Russell & Russell, 1962) 365.

⁶⁶ Becker, above, note 15.

⁶⁷ Eide, above, note 16, at 346.

⁶⁸ Following are some of the studies that have applied the Beckerian framework to consider the economics of copying; Becker, above, note 15; Johnson, above, note 14; Takeyama, above, note 14; Rochelandet & LeGuel, above, note 14.

are to effectively reduce circumvention and protect copyright owners' interests.

Therefore, this paper evaluates the effectiveness of Australia's anti-circumvention laws by analysing the resultant changes in the utilities of using and providing circumvention devices.

This analysis argues that anti-circumvention laws do not seriously reduce consumer-level copyright infringements, as they do not significantly lessen the instances of circumvention leading to those infringements. It has been indicated by economic study in the past that contravention may be discouraged by increasing the severity and probability of punishment.⁶⁹ This paper, however, explains why even high punishments and avid enforcement of Australian anti-circumvention laws will not significantly deter their contravention.

⁶⁹ This is the consensus of the many economic papers on crime and punishment. And while law-abiding individuals and contraveners choose to act differently, they will both respond to changes in the costs and benefits of breaking the law. Also, according to Becker's findings, the 'supply of crime' will diminish as the likelihood of arrest and the severity of punishment are increased; regardless of contravener risk-preference. Becker, above, note 15, at 176-8; Eide, above, note 16, at 345-6, 350.

[2.2] Model Assumptions

The majority of the assumptions of this paper arise simply because of the difference in legal and economic reasoning. Applying an economic model to the law necessitates the declaration of several fundamental assumptions that are inherent in economic theory. In this way, these models will share the strengths and weaknesses of other economic analyses of the law. However, these assumptions have gained widespread, inter-disciplinary acceptance over the last 30 years, and any model limitations are considered when inferences are drawn.⁷⁰

[2.2.1] Scarce Resources

Economics, in its essence, is the study of how individuals employ their resources in the most efficient manner.⁷¹ So while Pareto and Kaldor-Hicks efficiency are not considered, the basic assumption of a drive towards efficiency is retained. This assumption is simply refocused towards the individual; as opposed to the entire market, or society as a whole.⁷²

⁷⁰ Allen Consulting Group, above, note 63, at 8-10.

⁷¹ Id, at 8-9.

⁷² Eide, above, note 16, at 346.

This also means that the economic models developed in this paper assume that the resources under consideration are scarce, in the sense that the individual wishes to apply them in the most efficient manner possible.⁷³ This is a logical assumption, as a rational person will not expend more time or money, to acquire a given benefit, than is absolutely necessary.

[2.2.2] Rational Contravention

The biggest assumption in this economic analysis of the law, is that the individuals who are being assessed are rational contraveners, who break the law in order to improve their utility; that is, to improve the application of their scarce resources.⁷⁴

This is not a reasonable assumption if analysing very heinous crimes like murder, rape or bestiality, which can be linked to psychological illness or dysfunction, and may involve emotional, irrational or malicious intent.⁷⁵ But the assumption can be made for breaches that are largely driven by opportunism and financial reward, like private copyright infringement and TPM circumvention.⁷⁶ The average home consumer will not circumvent and

⁷³ Allen Consulting Group, above, note 63, at 9; Eide, above, note 16, at 352.

⁷⁴ Allen Consulting Group, above, note 63, at 9; Eide, above, note 16, at 345.

⁷⁵ Eide, above, note 16, at 345.

⁷⁶ Becker, above, note 15, at 170.

copy because they wish to destroy the copyright industries, or because they are mentally imbalanced. They will circumvent and copy because it is convenient and it is cost-effective. So, while this assumption is a serious one, it seems realistic in the case of anti-circumvention and copyright laws.⁷⁷

However, rational contravention theory also assumes that individuals are in a reasonable position to judge their own costs and benefits.⁷⁸ Without this assumption, individuals could not be expected to act rationally and according to the changes in the model. Their knowledge certainly does not need to be perfect, but they have to have some understanding of their environment, to allow them to calculate some reasonable estimates of the utility equation variables. This is a standard assumption for economic models, especially those that analyse the law using the deterrence hypothesis.⁷⁹

⁷⁷ This assumption has also been applied in other economic studies of financial and opportunistic contraventions, like copyright infringement. See, Takeyama, above, note 14; Johnson, above, note 14; Rochelandet & LeGuel, above, note 14; Kolm, above, note 16; Heineke, above, note 16; Eide, above, note 16.

⁷⁸ Lindsay (2002b), above, note 3, at 10.

⁷⁹ The 'reasonably informed participants' assumption is especially important in models relying on the deterrence hypothesis, because individuals must be aware of changes in legal penalty and enforcement, if they are to respond to them. See, Becker, above, note 15, at 176; Eide, above, note 16, at 354.

[2.2.3] The Deterrence Hypothesis

This paper also accepts, in line with the literature, that contravention rates and individuals should respond to changes in the severity and probability of legal punishment.⁸⁰ This element of rational contravention theory is known as the 'deterrence hypothesis' and is simply an altered application of the theory of demand.⁸¹ This hypothesis is a standard, necessary assumption, inherent in nearly every predictive, economic analysis of the law from the past 30 years.⁸²

[2.2.4] The Values in the Models

Consistent with the other economic analyses of copyright law, this paper accepts that the costs and benefits of copying and circumvention will vary among individuals.⁸³ Furthermore, in order to effectively apply these models, it must be assumed that all costs and benefits, even those related to psychological effects, must be able to be monetised.⁸⁴

⁸⁰ See note 69 above.

⁸¹ Garoupa, above, note 63, at 3, 8.

⁸² Eide, above, note 16, at 345.

⁸³ See, Novos I & Waldman M, 'The Effects of Increased Copyright Protection: An Analytic Approach' (1984) 92 *JPolitEconomy* 236; Johnson, above, note 14. For a tabled overview of such literature see, Allen Consulting Group, above, note 63, at 138.

⁸⁴ Eide, above, note 16, at 349-50.

[2.2.5] Terminology

In line with s 116AO(1), the terms 'dealer' and 'dealing', for the purposes of this paper, relate to the manufacture, importation, distribution, offering, communication or providing of circumvention devices in Australia. With reference to s 116AP(1), the term 'service provider' is taken to mean a person who offers a circumvention service to the public or provides such a service to another person. The term 'provider' is used to describe both of these parties together.

The terms 'device' and 'circumvention device' are used, per their s 10 definition, to mean 'a device, component or product (including a computer program)' capable of circumventing a TPM.

[2.3] Introducing the Models

The following models evaluate the utility of breaking anti-circumvention law. As rational contraveners, individuals perform the following economic analyses when they choose to contravene.

[2.3.1] *The Provider Model*

The Beckerian utilitarian 'criminal' theory is taken in its simplest form, and is used to represent the costs and benefits of breaking anti-circumvention law.

$$\text{Utility of Contravention} = \text{Benefits of Contravention} - \text{Costs of Contravention} - (\text{Perceived Probability of Punishment} \times \text{Cost of Punishment})$$

OR

$$U = B - C - (p \times C_{\text{LAW}})$$

U	– Utility of Contravention
B	– Benefits of Contravention
C	– Costs of Contravention
p	– Perceived Probability of Punishment
C _{LAW}	– Cost of Punishment

As illustrated by the above equation, the economic theory developed by Nobel prize-winner Gary Becker, considers the choice to engage in unlawful activities as a cost-benefit calculation.⁸⁵ This is a general equation for any contravention, but the model can be adapted to this anti-circumvention law analysis in the following way:

Providers:

$$\text{Utility of Providing} = \text{Benefits of Providing} - \text{Costs of Providing} - (\text{Perceived Probability of Punishment} \times \text{Cost of Punishment})$$

⁸⁵ Becker's model is far more complex than this. This is simply a mathematical representation of his general rational contravention theory. See Becker, above, note 15, at 176.

The model may then be reduced to the following variables:

<p>Providers:</p> $U_{DEAL} = B_{DEAL} - C_{DEAL} - (p_{DEAL} \times C_{AC-LAW})$	<p>U_{DEAL} – Utility of Providing</p> <p>B_{DEAL} – Benefits of Providing</p> <p>C_{DEAL} – Costs of Providing</p> <p>p_{DEAL} – Perceived Probability of Punishment</p> <p>C_{AC-LAW} – Cost of Punishment</p>
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To improve the predictive power of the model, this paper elaborates upon the costs and benefits of providing, by disambiguating the explanatory variables.⁸⁶

This providing model applies to two kinds of contravener; the circumvention device dealer and the circumvention service provider.

[2.3.1.1] *UTILITY OF PROVIDING (U_{DEAL})*

The utility of an action (U) indicates the net gain that an individual will appreciate from the given activity or transaction.⁸⁷ A rational individual will want to maximise this figure, and so will choose the option with the highest utility.

⁸⁶ As explained earlier, these costs and benefits will vary from individual to individual. This is consistent with Johnson, above, note 14, at 164.

⁸⁷ Rochelandet & LeGuel, above, note 14, at 2.

There are typically at least two options in any situation; either something is done or nothing is done. Doing nothing has a utility of zero, so in order for the alternative to be chosen, it must have a utility greater than zero.

The provider's options are to provide, or to do nothing. Therefore, for anti-circumvention laws to stop economically rational individuals from providing circumvention devices and services, they must reduce the utility of doing so below zero.

[2.3.1.2] PROVIDER BENEFITS⁸⁸

Firstly, circumvention device and service providers may break the civil provisions, ss 116AO and 116AP, for non-monetary reasons; for example, to appreciate the psychological benefits of being able to circumvent a sophisticated TPM. Providers may also breach these sections, as well as the criminal sections 132APD and 132APE, to gain the financial benefits that can result from commercially supplying circumvention devices and services.⁸⁹

Therefore the benefit variable is separated into financial (B_{FINC}) and non-monetary benefits (B_{PSYCH}).

⁸⁸ Economic studies have shown a clear relationship between the benefits of contravention and the propensity to engage in illegal activities, so these benefit variables are integrated into the equation. Eide, above, note 16, at 351.

⁸⁹ A criminal offence is only committed when the provider has breached anti-circumvention law 'with the intention of obtaining a commercial advantage or profit'. This applies for both ss 132APD and 132APE.

Providers:

$$B_{\text{DEAL}} = B_{\text{PSYCH}} + B_{\text{FINC}}$$

$$U_{\text{DEAL}} = (B_{\text{PSYCH}} + B_{\text{FINC}}) - C_{\text{DEAL}} - (p_{\text{DEAL}} \times C_{\text{AC-LAW}})$$

B_{PSYCH} – Non-Monetary Benefits

B_{FINC} – Financial Benefits

Non-Monetary Benefits (B_{PSYCH})

The B_{PSYCH} variable primarily comprises benefits that are gained, by the provider, from the accolades of others in the underground or inner circle community.⁹⁰ This may mean greater respect from the provider's peers, superior status or simply self-satisfaction.⁹¹

Financial Benefits (B_{FINC})

The second benefit that may be appreciated by providers is that of financial reward. If a circumvention device or service is provided for money, the

⁹⁰ Also included in this variable is any benefit gained from providing circumvention devices and services in protest of anti-circumvention law. There is some evidence that circumvention code, in particular DeCSS, is posted on web pages in protest of expanding copyright law and the resultant reduction of consumer rights. Any satisfaction appreciated from such activity is, obviously, a non-monetary benefit and is included in the B_{PSYCH} figure. See, Eschenfelder K, Howard G & Desai A, 'Who Posts DeCSS and Why?: A Content Analysis of Web Sites Posting DVD Circumvention Software' (2005) 56 *JASIST* 1405.

⁹¹ This respect may be derived from creating a new device that can circumvent a particularly robust TPM, or it may just come from the civil disobedience of liberating consumers.

amount received would constitute the B_{FINC} variable. Providers who provide services or devices 'with the intention of obtaining a commercial advantage or profit' (in this paper 'commercial providers') may be in breach of the criminal provisions 132APE or 132APD, in addition to the civil sections 116AO and 116AP.

[2.3.1.3] PROVIDER COSTS

The major transaction costs of dealing are those relating to the technology and time used to create, supply or apply the circumvention device, and also the costs of transmitting that device to the user.

<p>Providers:</p> $C_{\text{DEAL}} = C_{\text{TECH}} + C_{\text{TRANS}} + C_{\text{TIME}}$	<p>C_{TECH} – Technological Costs C_{TRANS} – Transmission Costs C_{TIME} – Time Costs of Providing</p>
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Technological Costs (C_{TECH})

The C_{TECH} variable relates to the cost of the technology that is necessary to create or provide the circumvention device or service.⁹²

⁹² For examples see section 3.2.3 at page 79 below. The inclusion of material costs is supported by the literature. See, Eide, above, note 16, at 351.

Transmission Costs (C_{TRANS})

Another major cost facing providers is the cost of transmitting the circumvention device to the user. Providers of software-based circumvention devices can transmit them cheaply over the internet, and therefore will have a low C_{TRANS} . Hardware devices can be considerably more expensive to deliver to the user, as they may require a physical location.⁹³

Time Costs of Providing (C_{TIME})

Whether the provider is manufacturing or supplying circumvention devices or services, a certain amount of time will go into the providing contravention.⁹⁴ This time could otherwise be spent earning income, so the opportunity cost of the provider's time is represented by the C_{TIME} variable.⁹⁵

The Law Cost Variable ($p_{\text{DEAL}} \times C_{\text{AC-LAW}}$)

This paper defines the 'law cost' of an activity, as the product of the perceived probability of being punished (p_{DEAL}) and the potential cost of the punishment

⁹³ If a shop-front is required, then rent expense will be incurred, and this could substantially reduce the utility of providing.

⁹⁴ For commercial providers, this will be the time taken to complete a sale. For non-commercial providers, this will be the time it takes the provider to transmit the circumvention device. For further details see section 3.2.5 at page 84 below.

⁹⁵ The introduction of an opportunity cost element is supported by the literature. See, Eide, above, note 16, at 350.

(C_{AC-LAW}) .⁹⁶ By multiplying the penalty by the percentage likelihood of being penalised, the expected legal punishment is factored into the utility calculation of a rational individual.⁹⁷

As there are both civil remedies and criminal punishments available under the *Copyright Act*, the law cost variable is not the simple product of two numbers, but rather the sum of two products.

Providers:

$$(p_{DEAL} \times C_{AC-LAW}) = (p_{CRIM} \times C_{AC-CRIM}) + (p_{CIVIL} \times C_{AC-CIVIL})$$

p_{CRIM}	– Probability of Criminal Punishment
p_{CIVIL}	– Probability of Civil Punishment
$C_{AC-CRIM}$	– Cost of Criminal Punishment
$C_{AC-CIVIL}$	– Cost of Civil Punishment

The Probability of Legal Punishment (p_{CRIM} & p_{CIVIL})

The p variable quantifies the perceived probability of being caught, prosecuted and ruled against in an Australian court. The p_{CRIM} variable

⁹⁶ The literature supports the addition of this element, as the majority of economic studies into unlawful behavior indicate that individuals can be deterred from engaging in illegal activities by increasing the probabilities and severities of punishments. See, Becker, above, note 15, at 176-177; Eide, above, note 16, at 345.

⁹⁷ The inclusion of expected punishment costs is supported by the literature. See, Eide, above, note 16, at 351.

represents the provider's probability of criminal punishment, under ss 132APD or 132APE, and the p_{CIVIL} variable corresponds to the probability of civil punishment, under ss 116AO or 116AP.

These p variables represent the perceived probability of punishment, not the actual probability, because this is a model that predicts individual activities.⁹⁸ So, naturally, the likelihood of contravention will hinge on the individual's perception of the costs and benefits of acting, not necessarily the actual costs and benefits.⁹⁹

Obviously, the perceived probability of being punished (p) will be strongly influenced by the actual rate of prosecution and punishment, but the correlation may not be perfect.¹⁰⁰

⁹⁸ The assertion that subjective beliefs are valid model components, even if these beliefs are incorrect, is supported by Becker and other academics in the field. See, Becker, above, note 15, at 176; Eide, above, note 16, at 354.

⁹⁹ This variable will, however, hinge largely on the media coverage of anti-circumvention law prosecutions, as this is generally the channel through which the public is informed about current legal proceedings. Providers will also be connected through informal channels, like online forums, web logs (blogs) and Internet Relay Chat (IRC), which are set up by hacker groups to inform members of current threats.

¹⁰⁰ As the actual p increases, the perceived p may increase at the same rate, at a greater rate, or at a lower rate.

The Cost of Legal Punishment ($C_{AC-CRIM}$ & $C_{AC-CIVIL}$)¹⁰¹

The cost of civil punishment variable ($C_{AC-CIVIL}$) is quantified as the remedy that is likely to result from a breach of s 116AO, for dealers, or s 116AP, for service providers. Similarly, the cost of criminal punishment variable ($C_{AC-CRIM}$) is based on the punishments prescribed in s 132APD for dealers and s 132APE for circumvention service providers.

Finalising the Provider Model

By elaborating upon the basic rational contravener model, this paper has improved the predictive power of this equation, and can proceed to apply it to Australian providers of circumvention devices and services.

$$U_{DEAL} = (B_{PSYCH} + B_{FINC}) - (C_{TECH} + C_{TRANS} + C_{TIME}) - (p_{CRIM} \times C_{AC-CRIM}) - (p_{CIVIL} \times C_{AC-CIVIL})$$

¹⁰¹ It could be argued that device providers would be liable for authorising copyright infringement and would thus be open to liability for very great civil damages. However, there are many complex arguments, both for and against the idea that providers would be held accountable for authorisation under the elements specified in s 36(1A) and s 101(1A). The issue is very indeterminate, and it would seem that the introduction of anti-circumvention laws is evidence enough that an authorisation case for a device provider would be very hard fought. Therefore, the only conclusion that can be drawn is that anti-circumvention law breaches are certain, while authorisation breaches are not. Therefore, the law cost variable for providers should only represent the possible anti-circumvention law remedies.

[2.3.1.4] WHEN WILL PROVIDING OCCUR?

In order to stop providers from providing circumvention devices and services, the utility of providing (U_{DEAL}) must be reduced below zero. Once the utility of providing becomes negative, the provider will be expending more than he or she gains. At this stage, providing becomes an inefficient employment of the provider's scarce resources, and as a rational contravener, the provider will cease providing.¹⁰²

So providing will only occur when:

$$U_{\text{DEAL}} > 0$$

OR

$$(B_{\text{PSYCH}} + B_{\text{FINC}}) - (C_{\text{TECH}} + C_{\text{TRANS}} + C_{\text{TIME}}) - (p_{\text{CRIM}} \times C_{\text{AC-CRIM}}) - (p_{\text{CIVIL}} \times C_{\text{AC-CIVIL}}) > 0$$

This paper will prove that Australia's anti-provider laws do not effectively reduce providing activity, as they do not lower U_{DEAL} below zero for a significant number of providers.

¹⁰² The provider will then choose the option of doing nothing, which has a utility of zero.

[2.3.2] *The User Model*

The same Beckerian rational contravener model can be applied to users of circumvention devices:

Users:

Utility of Circumvention = Benefits of Circumvention – Costs of Circumvention – (Perceived Probability of Punishment × Cost of Punishment)

And reduced to become:

Users:

$$U_{\text{CIRC}} = B_{\text{CIRC}} - C_{\text{CIRC}} - (p_{\text{CIRC}} \times C_{\text{AC-LAW}})$$

U_{CIRC}	– Utility of Circumvention
B_{CIRC}	– Benefits of Circumvention
C_{CIRC}	– Costs of Circumvention
p_{CIRC}	– Perceived Probability of Punishment
$C_{\text{AC-LAW}}$	– Cost of Punishment

[2.3.2.1] *USER BENEFITS OF CIRCUMVENTION*

Users of circumvention devices and services have far more complex benefits of contravention than providers. The objective of circumvention is essentially to gain the ability to access or copy content without authorisation; that is, without paying for a legitimate version. Therefore, the benefit of

circumvention (B_{CIRC}) will only be as great as the utility of copying or accessing (U_{COPY}). In other words, B_{CIRC} is equal to U_{COPY} .¹⁰³

The following model, which was presented by Rochelandet and LeGuel in their 2005 investigation into illegal file-sharing,¹⁰⁴ is consistent with the plethora of economic literature into copying and is nearly identical to many other economic copying models.¹⁰⁵

$U_{COPY} = \alpha V_O - P_C - C_C$	<p style="margin: 0;">U_{COPY} – Utility of Unauthorised Use</p> <p style="margin: 0;">V_O – Willingness to Pay for an Original</p> <p style="margin: 0;">P_C – Price of Copy</p>
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This model was specifically selected for its simplicity, so that it may be customised to suit the digital content considered in this investigation.

Utility of Unauthorised Use (U_{COPY})

The benefit of accessing a digital work is tantamount to the benefit of copying a hard-copy work, as each of these acts permit the use of the work without having to pay for an original version.¹⁰⁶ So while this variable is entitled

¹⁰³ Logically then, circumvention will not occur if the utility of unauthorised use (U_{COPY}) is insufficiently high to warrant incurring the costs of circumvention.

¹⁰⁴ Rochelandet & LeGuel, above, note 14, at 2.

¹⁰⁵ Takeyama, above, note 14, at 159; Johnson, above, note 14, at 162-164, 168.

¹⁰⁶ In the digital environment, it can be inappropriate to distinguish between copying and merely access. Typically, in the hard-copy world, a user would have to copy a product in

U_{COPY} , it represents the utility of using a work, without the authorisation to do so. Whether this act entails copying, or only unlawful access, it allows the use of a copy of the work without authorisation.

The Substitutability of Copies (α)

The substitutability factor represents how much product quality or usefulness differs between an original product and a copy.¹⁰⁷ If a VHS tape is replicated, much quality is lost and the copy is by far inferior. In this case α would have a low value, like 0.5. However, illegally downloaded mp3 files are almost as good as an original CD, except for an insignificant loss in sound-quality and a lack of jewel-case graphics.¹⁰⁸ This situation would yield a higher α value, like 0.8.

The improved replicability of digital content, relative to analogue material, means that, generally, the α variable will be 1, or very close to it.¹⁰⁹

order to use it. But in the digital world, the user may only need to access a work to make use of it. See example 3 on page 70, for a real-world example.

¹⁰⁷ Takeyama, above, note 14, at 158-159; Johnson, above, note 14, at 170; Rochelandet & LeGuel, above, note 14.

¹⁰⁸ CDs have a sample rate of 44.1 KHz (44,100 samples per second), but mp3 quality is generally lower to allow for faster and easier transfers. See, Zentner, above, note 31, at 70.

¹⁰⁹ This increase in substitutability has the exact same effect as a reduction of the price of copying (P_c), and has consequently improved the utility of unauthorised use significantly. See, Johnson, above, note 14, at 164, 171; Wang C, 'Factors that Influence the Piracy of DVD/VCD Motion Pictures' (2005) 6 *Journal of American Academy of Business* 231, at 232; Takeyama, above, note 14, at 161.

The Willingness to Pay (V_o)

The willingness to pay for the original product will depend on how highly the product is valued by the user, and is measured as the monetary price that the user is willing to pay.¹¹⁰ The consumer will not pay any more than V_o for the given product.¹¹¹ This value will vary from market to market and person to person, but will not be affected by anti-circumvention laws.

The Price of a Copy (P_c)

The P_c variable represents the cost of copying or accessing the work. If the work is copied, P_c equals the price of the medium on which the copy is reproduced,¹¹² like a hard disk, DVD-R or CD-R.¹¹³ If it is only accessed, then P_c may include the cost of a pirated copy bought from a commercial pirate, or any other fee incurred in order to illegally use the work.

Unlike the cost variable, the price variable is dictated by the market and is not affected by consumer preference or circumstance.¹¹⁴

¹¹⁰ Takeyama, above, note 14, at 157; Rochelandet & LeGuel, above, note 14, at 4.

¹¹¹ Novos I & Waldman M, 'The Effects of Increased Copyright Protection: An Analytic Approach' (1984) 92 *JPolitEconomy* 241.

¹¹² Massive improvements in digital technology have made both commercial and private copying substantially cheaper. See, Wang, above, note 109, at 231.

¹¹³ Takeyama, above, note 14, at 158-159; Rochelandet & LeGuel, above, note 14, at 2.

¹¹⁴ The introduction of TPMs reduces product functionality, while retaining the same price, so one would be tempted to believe that is it tantamount to an increase in price (P_o).

The Transaction Costs of Unauthorised Use (C_C)

The transaction costs of unauthorised use are quite complex and diverse. This paper will divide the C_C variable into 4 major sub-costs, so that they may be individually identified and applied in the model.

$$C_C = C_{\text{PARTNER}} + (p_{\text{COPY}} \times C_{\text{LAW}}) + C_{\text{ETHIC}} + C_{\text{VIRUS}}$$

These sub-costs were selected based on econometric studies, which found them to be highly correlated with the likelihood of copying.¹¹⁵ The variables excluded from the models have no effect on the likelihood of copying, and are purely explanatory, not predictive.¹¹⁶ So they would not affect utility and would be irrelevant to this economic analysis.

However, John Rothchild has proven this hypothesis incorrect. See, Rothchild, above, note 18, at 515-517.

¹¹⁵ Rochelandet & LeGuel, above, note 14, at 5.

¹¹⁶ These variables include: demographics, the level of cultural spending and the experience with copying. These variables, may explain what type of person would typically copy, but they are not costs or benefits of breaking the law and will not change an individual's decision to contravene. Rochelandet & LeGuel, above, note 14, at 5.

The Cost of Finding a Copy (C_{PARTNER})

First and foremost is the cost of finding a copy partner. This can be very low for mp3s on a file-sharing network,¹¹⁷ but can be very high for a specialty copyright product, like a live ABBA concert released solely on Laserdisc.¹¹⁸ This variable depends largely on the avenues of 'content sharing' that are open to the user. The C_{PARTNER} variable is potentially the most crucial element of the copying equation, as without a partner, or access to a file, copying cannot occur at all.

C_{PARTNER} differs from the P_C variable explained above. C_{PARTNER} is the cost of finding and acquiring a copy, that the user may reproduce or illegally access. P_C , on the other hand, represents the costs incurred in the actual process of reproducing or accessing that copy.

The Psychological Costs of Copying (C_{ETHIC})

Psychological costs are a result of ethical concerns that an infringer has over breaking the law and reaping the fruit that another has sown.¹¹⁹ These

¹¹⁷ Wang, above, note 109, at 232.

¹¹⁸ The Laserdisc was the first optical disc storage medium ever commercially distributed. Laserdiscs achieved only limited use from the late 70s until the early 90s, when they were made obsolete by the Video Compact Disc (VCD) and Digital Versatile Disc (DVD).

¹¹⁹ Rochelandet & LeGuel, above, note 14, at 4.

concerns are dependent on the individual's conscience, moral integrity and opinion regarding the validity of legal restrictions.

Psychological costs are less important for this analysis, as it has been found that society has not developed a strongly negative stigma with copyright infringement;¹²⁰ as it has for other breaches of the law.¹²¹ For this reason, the psychological costs will remain rather small.

The Risk of Contracting a Digital Virus in a Copy (C_{VIRUS})

Digital viruses, spy-ware and other malicious software may be attached to infringing copies, and can damage a user's data or log their personal details and activities.¹²² The risks and costs of rectifying such infections are included in this 'virus cost' variable.¹²³

¹²⁰ Kulpa A, 'Distributing Yesterday's Media, Tomorrow: How Media Companies Mask Antiquated Operating Models With the Veil of Copyright' 16 *SHJSEL* 225, at 234-236; Lessig, above, note 37, at 200.

¹²¹ Some argue that this is because of the expansion of copyright, and the fact that modern copyright is vastly different from its 18th century origins. See, Fitzpatrick S, 'The Death of the Recording Industry?' (2002) 7 *Media & Arts Law Review* 273, at 276-277; Lessig, above, note 37, at 200. Also, see generally Weatherall (2004b), above, note 8; Weatherall K, 'Locked In: Australia Gets a Bad Intellectual Property Deal' (2004a) 20 *Policy* 18.

¹²² User details and activities are typically logged and transmitted to the virus creator, to allow a future scam or exploit at the user's expense.

¹²³ Of the Europeans who have cut down on their file-sharing, 35 per cent have done so because of concerns over viruses and other malicious software. An equivalent figure of 46 per cent is given for Japanese downloaders, in the 2007 Digital Music Report of the International Federation of the Phonographic Industry (IFPI). See, International Federation of the Phonographic Industry, *The Recording Industry 2006 Piracy Report* (UK: IFPI, 2006), at 7: <<http://www.ifpi.org/content/library/piracy-report2006.pdf>> (1 Aug 2007); International Federation of the Phonographic Industry, *IFPI 2007 Digital Music*

The Law Cost Variable for Copying ($p_{\text{COPY}} \times C_{\text{LAW}}$)

The user law cost variable for copying is very similar to the provider law cost variable for providing circumvention devices and services. The p_{COPY} variable represents the perceived probability of being punished and C_{LAW} is the potential cost of the punishment for a copyright infringement.

Substituting the Expanded Benefit Elements

So when these new costs are substituted in, the U_{COPY} model becomes:

$$\text{Users: } U_{\text{COPY}} = \alpha V_{\text{O}} - P_{\text{C}} - C_{\text{C}}$$

$$C_{\text{C}} = C_{\text{PARTNER}} + (p_{\text{COPY}} \times C_{\text{LAW}}) + C_{\text{ETHIC}} + C_{\text{VIRUS}}$$

$$U_{\text{COPY}} = \alpha V_{\text{O}} - P_{\text{C}} - (C_{\text{PARTNER}} + (p_{\text{COPY}} \times C_{\text{LAW}}) + C_{\text{ETHIC}} + C_{\text{VIRUS}})$$

By elaborating upon the U_{COPY} model's cost variable, this paper has improved the traditional copying model, such that it can reasonably predict the unauthorised use of digital content by Australian individuals.

Report (UK: IFPI, 2007a), at 21: <<http://www.ifpi.org/content/library/digital-music-report-2007.pdf>> (1 Aug 2007).

This paper now proceeds to substitute the enhanced model for the utility of unauthorised use (U_{COPY}), in place of B_{CIRC} in the circumvention utility model:¹²⁴

Users:

$$B_{\text{CIRC}} = U_{\text{COPY}} = \alpha V_O - P_C - (C_{\text{PARTNER}} + (p_{\text{COPY}} \times C_{\text{LAW}}) + C_{\text{ETHIC}} + C_{\text{VIRUS}})$$

$$U_{\text{CIRC}} = \alpha V_O - P_C - (C_{\text{PARTNER}} + (p_{\text{COPY}} \times C_{\text{LAW}}) + C_{\text{ETHIC}} + C_{\text{VIRUS}}) - C_{\text{CIRC}} - (p_{\text{CIRC}} \times C_{\text{AC-LAW}})$$

[2.3.2.2] USER COSTS OF CIRCUMVENTION

To improve the predictive power of the circumvention model, the cost variable (C_{CIRC}) must be expanded into its base elements; just as the provider cost variable was. This paper adds the following cost elements specifically, as they are the principal costs that are inflicted on a user by TPMs and anti-circumvention laws.

$$C_{\text{CIRC}} = C_{\text{DEVICE}} + C_{\text{CIRCETHIC}} + C_{\text{CIRCVIRUS}}$$

C_{DEVICE}	– Cost of Acquiring a Circumvention Device
$C_{\text{CIRCETHIC}}$	– Psychological Cost
$C_{\text{CIRCVIRUS}}$	– Cost of Getting a Digital Virus

¹²⁴ Recall from the beginning of section 2.3.2.1, that the benefits of circumventing (B_{FIRC}) are only as great as the utility of unauthorised use (U_{COPY}).

The Law Cost Variable for Circumvention ($p_{\text{CIRC}} \times C_{\text{AC-LAW}}$)

The user's law cost variable for circumvention is much the same as that of the provider, as it factors in the expected anti-circumvention law punishment to befall a device user.

The Cost of Acquiring a Circumventive Capability (C_{DEVICE})

TPMs introduce to the model the cost of acquiring circumventive capability; as without this the user cannot circumvent the TPM, and thus cannot make unauthorised use of the copyright content. If the device or service is provided commercially, then C_{DEVICE} will include the price charged for it. If provided freely, then C_{DEVICE} will depend on the amount of time it takes for the user to find and acquire the circumvention device or service.

This cost can be very large, if the TPM is very difficult to circumvent, or the content is esoteric, as an inner-circle member may not yet have created an appropriate device.¹²⁵ Conversely, the cost of acquiring a circumvention device for a widely used product, which has a simple TPM, will be lower.¹²⁶

¹²⁵ This would apply to something like 'Chief Architect', which is highly specific Australian architecture software, used only by professionals. Even though this software costs between AU\$2,200 to AU\$4,300, and the benefits of copying would be substantial, the

The Cost of Contracting a Digital Virus from a Circumvention Device ($C_{CIRC\text{VIRUS}}$)

There is some risk, and associated cost, to the user that a virus will be embedded in a given circumvention device. This variable is similar to the C_{VIRUS} transaction cost of copying, but is generally greater, due to the underground affiliations of circumvention device providers.¹²⁷ The C_{VIRUS} variable is also smaller than $C_{CIRC\text{VIRUS}}$ because the content that is copied or accessed is often just data that is read or processed by existing user software. It is far more difficult to embed viruses into plain data like music or video files, than it is to infect a file that is actually run by a user's PC, like a circumvention device.¹²⁸ Nonetheless, the expected cost of dealing with a contracted virus is typically very small, relative to the benefits of circumvention, so this variable will have a low magnitude.

very limited demand for a circumvention device means supply would be scarce. See, Chief Australia, 'Overview', Welcome to Chief Australia: <<http://www.chiefaustralia.com.au/overview.asp>> (10 Jul 2007).

¹²⁶ The DVD's CSS TPM is a perfect example of this, as the widely used 'DVD Shrink' software is available from many free sources, at high speed. This software circumvents CSS and allows the backing up of DVD movies. See, 'What is DVD Shrink?' <<http://www.dvdshrink.org/what.html>> (10 Jul 2007). DVD Shrink is also available at, 'DVDShrink Guide' <<http://www.mrbass.org/dvdshrink/>> (10 Jul 2007); 'Download DVD Shrink Now' <<http://dvdshrink-download-now.com/index.asp>> (10 Jul 2007); 'Download the Latest Version of DVD Shrink 2007' <<http://www.dvdshrink--download.com/shrinkdvd/index.asp>> (10 Jul 2007).

¹²⁷ These underground groups are akin to those that release malicious programs like digital viruses, spyware and adware. Therefore, there is probably a more significant risk that circumvention devices will be imbedded with malicious software.

¹²⁸ This is why executable files, with extension '.exe', are banned from transfer by the popular MSN Messenger chat program, many email service providers, like Hotmail and the University of Sydney, and even the Microsoft Outlook electronic mail client.

The Psychological Costs of Circumventing ($C_{CIRCETHIC}$)

The ethical costs of circumvention are augmented by anti-circumvention laws, as multiple, distinctly separate laws must be broken in order to circumvent and copy. Nevertheless, this cost will remain very low, because of society's acceptance of private, non-commercial copyright law contraventions.¹²⁹

Substituting the Expanded Cost Elements

These new costs may be incorporated into the equation, to give:

$$U_{CIRC} = \alpha V_O - P_C - (C_{PARTNER} + (p_{COPY} \times C_{LAW}) + C_{ETHIC} + C_{VIRUS}) - (C_{DEVICE} + C_{CIRCETHIC} + C_{CIRCIVIRUS} + (p_{CIRC} \times C_{AC-LAW}))$$

Some of the costs of circumvention may be combined with the costs of copying, to simplify the equation. However, to properly illustrate how anti-circumvention laws affect U_{CIRC} , they shall remain separate.

By disambiguating the explanatory variables and applying the traditional copying model to the Beckerian rational contravention model, this paper

¹²⁹ Kulpa, above, note 120, at 234-236; Lessig, above, note 37, at 200; Wang, above, note 109, at 231, 233-234; Entertainment Media Research & Olswang, 'The 2007 Digital Music Survey' <http://www.entertainmentmediaresearch.com/reports/EMR_Digital_Music_Survey2007.pdf> at 75 (9 Aug 2007).

gives new insight into the factors effecting circumvention. The improved model is now fit to analyse and predict the utility of circumvention, and to illustrate how anti-circumvention laws affect utility.

[2.3.2.3] *WHEN WILL CIRCUMVENTION AND PIRACY OCCUR?*

Unlike the provider, the user has three options. The user can circumvent and use the work illegally, buy an original, or do nothing.¹³⁰ This means that the utility of circumvention (U_{CIRC}) must only be reduced below the greater of the utility of buying (U_{BUY}) and the utility of doing nothing; which is zero.¹³¹

What is U_{BUY} ?

Earlier studies have developed the following model for the utility of buying an original:¹³²

$U_{BUY} = V_O - P_O - C_O$	U_{BUY} – Utility of Buying an Original V_O – Willingness to Pay for an Original P_O – Price of an Original
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¹³⁰ If the utility of buying (U_{BUY}) is greater than the utility of circumvention (U_{CIRC}), then a user will choose to buy a legitimate version, instead of expending excessive resources in acquiring an illegitimate one.

¹³¹ Once the utility of circumventing (U_{CIRC}) is negative, circumvention will not occur, regardless of whether the utility of buying (U_{BUY}) is more deeply negative.

¹³² Takeyama, above, note 14, at 159; Johnson, above, note 14, at 162-164, 168; Rochelandet & LeGuel, above, note 14, at 2.

The price of the original (P_o) is simply the price charged by a local, legal distributor.¹³³ The transaction costs of acquiring an original (C_o) will include any ancillary costs incurred in acquiring the product; like transport to and from the sales location.¹³⁴

When will Circumvention Occur?

When $U_{BUY} \geq 0$, circumvention will occur when:

$$U_{CIRC} > U_{BUY}$$

When $U_{BUY} < 0$, circumvention will occur when:

$$U_{CIRC} \geq 0$$

In other words, a user will unlawfully use content, when doing so results in a greater net benefit than buying an original, or doing nothing.¹³⁵ As α is less than one, the positive difference between U_{BUY} and U_{CIRC} will increase as the willingness to pay (V_o) decreases.¹³⁶ That is, it is more likely that a user will

¹³³ Johnson, above, note 14, at 164; Takeyama, above, note 14, at 157; Rochelandet & LeGuel, above, note 14.

¹³⁴ Rochelandet & LeGuel, above, note 14, at 2.

¹³⁵ Johnson, above, note 14, at 164; Rochelandet & LeGuel, above, note 14, at 2.

¹³⁶ Assume that all of the costs and prices involved are held constant, and can thus be ignored when assessing the absolute difference between copying utility and buying utility. In this case, V_o less αV_o equals the positive difference between U_{BUY} and U_{COPY} . So if the substitutability factor (α) is 0.7, and the willingness to pay (V_o) decreases from 10 to 5, then: $10 - (0.7 \times 10) = 3$ and $5 - (0.7 \times 5) = 3.5$. So the utility of buying (U_{BUY}) increases with V_o directly, while the utility of unauthorised use (U_{COPY}) only increases with a correlation coefficient of α , which is 0.7 in this case. As the calculation illustrates, this

circumvent and copy or access unlawfully, if that user has a lower willingness to pay.¹³⁷

This paper proves that Australia's anti-circumvention laws do not effectively reduce U_{CIRC} below U_{BUY} or zero, for a significant number of users.

[2.3.3] *How the User and Provider Models are Linked*

As explained in section 1.4.4, users are highly dependent on the inner-circle supply of circumventive capability, as without this they cannot circumvent and engage in piracy. This relationship connects the user and provider models, such that factors affecting providers, and the supply of circumventive capability, will have flow on effects for the user.

[2.3.3.1] *PROVIDERS DEALING WITH COSTS*

To illustrate the connection between the models, consider a situation where all providers suffer increased costs.

relationship causes to positive difference between U_{BUY} and U_{COPY} to increase as V_o decreases.

¹³⁷ Rochelandet & LeGuel, above, note 14, at 4.

Non-Commercial Providers are Deterred

An increase in the cost of providing may effectively deter non-commercial providers, who have low psychological benefits (B_{PSYCH}). Psychological benefits are the result of a provider's mindset and environment, and are typically out of his or her control. So, non-commercial providers respond to cost increases much like users do. If anti-circumvention laws increase their costs far enough to push their utility below zero, they will cease their illegal providing activities, as the risks of legal punishment will outweigh the net benefits that they appreciate from providing.

Commercial Providers Raise their Prices (B_{FINC})

While non-commercial providers can be deterred by cost increases, the same effect is not appreciated for commercial providers. Rather, increased costs simply drive commercial providers to enhance the financial benefits that they reap from providing (B_{FINC}), by increasing the prices of their circumvention devices and services.

So, unlike psychological benefits, financial benefits can be adapted to suit the market and the costs of providing. This allows the commercial provider to

retain a positive utility, and to continue to provide, even when costs are increased.

[2.3.3.2] *USERS SUFFER GREATER DEVICE ACQUISITION COSTS (C_{DEVICE})*

Commercially Sold Devices Become More Expensive

By increasing their device and service prices (B_{FINC}), commercial providers effectively increase the users' device acquisition costs (C_{DEVICE}).¹³⁸

Freely Provided Devices Become Scarcer

Unlike the commercial market analysed above, the non-commercial market does not hinge on the prices of circumvention devices and services. Rather, because these devices and services are free, the only provider-dependent cost that the user incurs is the opportunity cost of the time used to find and acquire circumventive capability.

The time aspect is crucial. By cutting out the non-commercial providers with the lowest utilities, the cost increase effectively reduces the supply of

¹³⁸ This is true because the C_{DEVICE} variable includes the price paid for the circumvention device or service. See section 2.3.2.2 at page 55 above.

circumventive capability. This means it will take longer for users to find the non-commercial devices and services, and their device acquisition costs (C_{DEVICE}) will increase accordingly.¹³⁹

¹³⁹ For actual figures on this, see section 4.4.2 at page 149 below.

3 EXAMPLE APPLICATION

[3.1] The Examples

As David Lindsay observed; 'it is...notoriously difficult to determine individual utility'.¹⁴⁰ This difficulty is caused by the number of variables that change from individual to individual, and the trouble with quantifying non-monetary variables, like willingness to pay and the psychological costs and benefits of contravention.

Nonetheless, this paper does value the model variables, and assesses the utility of circumvention and the utility of providing circumvention devices and services. Where empirical data was not available, or such data could not realistically have been acquired,¹⁴¹ the variables in the models were valued using reasonable predictions, and were varied to ensure the validity of this paper's assertions.¹⁴² In order to prove the robustness of the models, and the argument presented in this paper, the variable values were taken at the

¹⁴⁰ Lindsay (2002b), above, note 3, at 10.

¹⁴¹ Providers of circumvention devices and services rarely enjoy advertising their activities, for fear of prosecution. This means that actual figures for every variable in the equation would be extraordinarily difficult to acquire, if not impossible.

¹⁴² The models' values are explained in detail in sections 3.2, 3.3 and 3.4 below.

extreme end of realistic levels, such that they exaggerate the deterrent effect of anti-circumvention laws.¹⁴³

Four different TPM and circumvention device sets were chosen, to apply the model in a broad context and to demonstrate the applicability of the results to the different types of Australian TPMs. These specific examples were chosen for their prominence in Australian society and their contrasting attributes. Both the providers and users of each circumvention device are considered, to assess their interdependencies and to paint a full picture of reality.

[3.1.1] 1 *DVD Example*

Why this TPM?

DVD movies and the 'DVD Shrink' circumvention software are taken as the first example. DVD movies and players are widespread throughout Australian society, and DVD copying has become simpler and cheaper in recent years.

'DVD Shrink' is a piece of circumvention software that is freely available online, and can remove the Content Scramble System (CSS) TPM that protects

¹⁴³ That is, where any variable could realistically fluctuate, the value of that variable is taken at the level that makes anti-circumvention laws appear most effective.

movie-DVDs. There are many other free CSS circumvention tools available, and the particular DVD Shrink software is not integral to the results. It is chosen simply because it is one of the most popular and widespread CSS circumvention tools on offer.

Example Specifics

As CSS circumvention devices are available from numerous free sources, this DVD Shrink provider is taken to be a non-commercial contravener. This non-commercial supplier provides DVD Shrink, but did not manufacture it, and so has no development costs. None of the providers considered in the examples have manufactured the devices that they provide, as the vast majority of device development and manufacture occurs outside Australia,¹⁴⁴ and thus outside the models.¹⁴⁵

¹⁴⁴ Note that s 116AM limits the application of Australia's anti-circumvention laws to acts done in Australia.

¹⁴⁵ Moreover, if development costs were introduced to the models, the cost increases imposed by anti-circumvention laws would appear less significant. So to err on the side of caution, no development costs are included. See these Chinese circumvention device manufacturers, 'Future (China) Company Limited' <<http://futurechina.manufacturer.globalsources.com/si/6008824914942/Homepage.htm>> (14 Sep 2007); 'Manufacturer of China Products – Future (China) Company Limited' <<http://futurechina.manufacturer.globalsources.com/si/6008824914942/Showroom/3000000149681/ALL/2.htm>> (14 Sep 2007); 'Modchip, China Modchip, Modchip Manufacturers, China Modchip Catalogue' <<http://www.made-in-china.com/products-search/hot-china-products/Modchip.html>> (14 Sep 2007).

This provider already has a competent PC and is skilled with computers. Therefore, the provider chooses to provide by uploading the DVD Shrink installation file on a familiar Bit Torrent network.

The user rents the desired DVD movie from a local video store, and downloads the DVD Shrink software in order to copy it.

Is it representative?

The model could be similarly applied to movies distributed on HD-DVD or BluRay discs, once an equally accessible circumvention device is developed for them.¹⁴⁶ Their TPMs have not yet been 'cracked', so users may not circumvent them. However, this is a product of the technical complexity and sophistication of the TPM, not the effect of anti-circumvention laws. So, in the future, these media may also be circumvented, and at this time, the DVD results given here will be applicable to them as well.

¹⁴⁶ The Advanced Access Control System (AACS) protects both BluRay and HD-DVD movies. The Win DVD 8 HD-DVD player has been compromised and its encryption key, capable of circumventing the AACS TPM, has been released online. However, this key has been revoked by the AACS managers and will not allow unauthorised playback or copying of new discs. See, Mattock N and Petrie H, 'Hackers 1, Hollywood Film Studios 0 : Blu Ray And High Definition DVD Security Hacked In A Matter Of Days', *Mondaq Business Briefing*, 29 March 2007; Segan S, 'Digg Users Storm the Bastille', *PC Magazine*, 5 July 2007: <<http://www.pcmag.com/article2/0,1895,2124848,00.asp>> (12 Jul 2007); Jesdanun A, 'Users Rebel at User-Recommendation Site', *Associated Press*, 2 May 2007: <<http://www.foxnews.com/wires/2007May02/0,4670,TechBitDiggRebellion,00.html>> (13 Sep 2007).

[3.1.2] 2 *PlayStation Example*

Why this TPM?

The second example involves the most heated topic in Australian anti-circumvention law; PlayStation modification chips (mod-chips). This example was chosen to consider the circumvention devices that have seen so much Australian publicity, since the series of cases in the *Sony v Stevens* litigation.¹⁴⁷

Although these cases involved PlayStation 1 consoles, the more modern PlayStation 2 and its mod-chips will be used for this example. The PlayStation 1 is now obsolete, and this investigation must remain relevant to modern TPMs. Nevertheless, PlayStation 2 mod-chips are about as difficult and expensive to acquire and install as PlayStation 1 mod-chips.

¹⁴⁷ *Kabushiki Kaisha Sony Computer Entertainment v Stevens* (2001) 116 FCR 490 (FCA); *Kabushiki Kaisha Sony Computer Entertainment v Stevens* (2002) 200 ALR 55 (FCA); *Kabushiki Kaisha Sony Computer Entertainment v Stevens* (2003) 132 FCR 31 (FCAFC); *Stevens v Kabushiki Kaisha Sony Computer Entertainment* (2005) 221 ALR 448 (HCA).

Example Specifics

This example involves a circumvention service provider, who runs a small electronics repair shop, and installs mod-chips on the side. This provider is commercial, but does not manufacture the chips that are installed.¹⁴⁸

The user attends the store, has the circumvention service provided and proceeds to pirate PlayStation games to play on the mod-chipped console.¹⁴⁹

Is it representative?

While this example is focused specifically on the PlayStation 2 console, the models could be applied equally to other consoles that have similarly circumventable TPMs. These consoles include the PlayStation Portable (PSP), Xbox, Xbox 360, Nintendo GameCube and the Nintendo Wii.¹⁵⁰

¹⁴⁸ The chips are purchased from mainland China. See, 'Modchip, China Modchip, Modchip Manufacturers, China Modchip Catalogue' <<http://www.made-in-china.com/products-search/hot-china-products/Modchip.html>> (14 Sep 2007).

¹⁴⁹ It is assumed, for this example, that users simply bring their PlayStation 2 consoles to the mod-chip provider, for it to be chipped. This identifies the provider as a service provider, as opposed to a device supplier.

¹⁵⁰ These consoles also have readily available mod-chips, which can circumvent their respective TPMs. See, 'Mod-chip G Cube' <<http://www.modchip-land.com/?pag=cat&cat=12&title=Modchip---G-Cube>> (8 Sep 2007); Consoletronics, 'PS2 Xbox Modchip Specialist in Sydney' <<http://www.consoletronics.com>> (2 Aug 2007); 'Xbox 360 Mods & Upgrades' <<http://cracker.com.au/classifieds/sydney/for-sale/videogames/274509058.aspx>> (31 Aug 2007); 'PS2 Xbox Wii Xbox 360 Mods Repairs and Upgrades (Frenchs Forest)' <<http://cracker.com.au/classifieds/sydney/for-sale/videogames/306271607.aspx>> (31 Aug 2007); 'Australia's Leading Repairs Specialist XBOX360 Wii (BALMAIN)' <<http://cracker.com.au/classifieds/sydney/for-sale/videogames/304843097.aspx>> (31 Aug 2007); 'Premods, Repairs, Installs, Modchips

[3.1.3] 3 *DesignPro Example*

Why this TPM?

The third example builds upon the software circumvention device evaluation in the DVD example, but focuses on TPM protected software, and depicts a commercial device provider.

This fictional graphics editing software is entitled 'DesignPro', and is taken as representative of the many graphic design programs that use fully functional trial versions, which are shut down by TPMs after a specified period.¹⁵¹ The equally fictional software-based circumvention device for DesignPro's TPM is called 'ProBuster'.

Example Specifics

This example's provider supplies the ProBuster circumvention device, which can crack the TPMs on the trial version of DesignPro, to give it the same

(Bankstown)' <<http://cracker.com.au/classifieds/sydney/for-sale/videogames/299830816.aspx>> (31 Aug 2007).

¹⁵¹ This period is usually 30 days. See, for example, Corel, 'Painting/Natural Media – Corel Painter Essentials 3' <<http://www.corel.com/servlet/Satellite/us/en/Product/1152105062012>> (9 Sep 2007); Adobe, 'Adobe – Photoshop CS3, Photo Editing Software, Digital Image Editor' <<http://www.adobe.com/products/photoshop/photoshop/>> (15 Sep 2007); Adobe, 'Adobe – Illustrator CS3, Digital Graphic Design Software, Computer Aided Design Software, Computer Graphic Design Solution' <<http://www.adobe.com/products/illustrator/>> (15 Sep 2007).

functionality as the full product. This provider does not supply pre-circumvented software, only the device and the web address to download the trial. This provider makes the device available through a basic website, and uses an eBay/PayPal account for advertising and payments.

Users download and install the DesignPro trial, after which they apply the ProBuster circumvention device.

[3.1.4] 4 CADman Example

Why this TPM?

The final example involves another commercial provider of hardware circumvention devices. These devices, however, allow the use of only one specific piece of software, unlike the PlayStation mod-chip, which can permit the use of many different games.

This example is based on a fictional piece of software, which is considerably more expensive than DesignPro, and is named 'CADman'. This software is representative of Computer Aided Design (CAD) and 3D Design programs, which use TPMs that can only be circumvented using a hardware

circumvention device, in the form of a dongle.¹⁵² A pirated version of CADman may only be run while the circumventing dongle, called the 'Crackman', is plugged into the user's computer.¹⁵³

Example Specifics

This Crackman provider sells devices at a stall in a popular weekend market, but does not provide the pirated CADman software. This item is supplied by the neighbouring stall at the market.

It is assumed, for this example, that the user purchases a pirated copy from the neighbouring stall and subsequently uses the Crackman dongle to run it.

[3.1.5] *Are they s 10 TPMs?*

There has been much consternation over what protections will fall within the access control TPM definition in s 10. This is due, largely, to the complexity in the drafting of the provision and the lack of interpretive common law.

¹⁵² The Autodesk group is infamous for using dongles to prevent copying of their products. See these Autodesk products, Autodesk, 'Autodesk – AutoCAD' <<http://usa.autodesk.com/adsk/servlet/index?siteID=123112&id=2704278>> (15 Sep 2007); Autodesk, 'Autodesk – Autodesk 3ds Max' <<http://usa.autodesk.com/adsk/servlet/index?siteID=123112&id=5659302>> (15 Sep 2007).

¹⁵³ The Crackman dongle is not dissimilar to the original dongle, in that it simply replicates the algorithmic look-up table that is used by the DesignPro TPM to verify the software's authenticity.

Some academics have suggested that nearly any protection will fall within the definition,¹⁵⁴ while others have argued that, like in *Sony v Stevens*, the courts will narrow the effect of the laws.¹⁵⁵ This divergence of opinion makes it very difficult to state conclusively which protections will be considered access control TPMs.

The DesignPro and CADman examples would, more likely than not, be considered access control TPMs. The DesignPro protections control access by limiting the duration that the trial program may be run for, before the user must purchase a licence key from the copyright owner.¹⁵⁶ Similarly, access to the CADman software is blocked by its protection measures until the correct algorithm response is received from the attached dongle.¹⁵⁷ These systems

¹⁵⁴ Fitzgerald, above, note 5.

¹⁵⁵ The EM accompanying the Copyright Amendment Bill 2006 indicates, at para 12.7, that: 'The fact that a measure is applied to a work or other subject-matter in which copyright subsists would not be sufficient, in and of itself, to establish the link. The use of the measure must be connected to the exercise of an exclusive right by the owner of the copyright in that work or other subject-matter.'

Kimberlee Weatherall argues that the statute, and this part of the EM, together allow considerable scope for the courts to narrow the access control TPM definition, as they did for the previous TPM definition in *Stevens v Kabushiki Kaisha Sony Computer Entertainment* (2005) 221 ALR 448 (HCA). See, Weatherall K, 'The New TPM Provisions in the Copyright Amendment Bill' *Weatherall's Law* 2006 <<http://weatherall.blogspot.com/2006/10/new-tpm-provisions-in-copyright.html>> (26 Sep 2007).

¹⁵⁶ As quoted in note 155 above, the EM indicates that the courts may narrow the meaning of 'in connection with copyright' to require a link to the exercise of an exclusive right. While access is not an exclusive right of a copyright owner, reproduction is. The broadening of the 'material form' definition, as detailed in note 275 below, may deem the RAM reproductions, necessary to run the DesignPro software, a reproduction in material form. This would link the access control TPM to an exclusive right.

¹⁵⁷ The argument from note 156 above is equally applicable to the CADman TPM.

should attract legal protection as they control 'access to the work...in the normal course of [their] operation...in connection with the exercise of...copyright'.¹⁵⁸

However, there is further ambiguity over whether the protections in the first two examples are TPMs under the Act, as they involve both copyright-protective elements and also region-coding elements, which serve to geographically segment markets.¹⁵⁹ TPMs are excluded from the s 10 definitions, 'to the extent that' they have the latter effect.

This may mean that only the copyright-legitimated elements of the TPM are protected, or it might be argued that the entire TPM is excluded from protection, if the region-coding and copyright-protective elements of the TPM cannot be circumvented separately.¹⁶⁰ It could even be argued that the TPMs

¹⁵⁸ These protections meet the s 10 definition of 'controls access', as they 'require...the application of information or a process... to gain access to the work'. The required information would be the legitimate licence key, for DesignPro, and the algorithm data derived from the dongle, for CADman.

¹⁵⁹ The s 10 definition only excludes TPMs which geographically segment markets by 'preventing the playback in Australia of a non-infringing copy of the work or other subject-matter acquired outside Australia'.

¹⁶⁰ Paragraph 12.1 of the EM accompanying the Copyright Amendment Bill 2006 (Cth) states that:

'Where an access control has different functions but each function cannot be circumvented independently, that access control would be considered to be only one access control TPM.'

The PlayStation and DVD protection systems combine the region-coding and access-control functions, such that they cannot be separately circumvented. Therefore, it could be argued that they each have only one TPM, and that part of these TPMs

may be circumvented, in order to play movies or games that have been legitimately purchased overseas, but are otherwise protected by law.¹⁶¹

Nonetheless, the House of Representatives Standing Committee, when considering the anti-circumvention articles of the AUSFTA, seemed to believe that the DVD and PlayStation systems would receive protection as access control TPMs.¹⁶² This argument also has some academic support, with regard to the current laws.¹⁶³

Even so, this issue can only be decided by future cases. An intricate legal analysis of this point is beyond the scope of this paper and would, without legal authority, still be open to debate. However, this paper proceeds on the basis that there is support that these are, or at least arguably are, TPMs under

‘control...geographic market segmentation’. This could exclude them from protection under Australian anti-circumvention law, altogether.

¹⁶¹ Weatherall (2006), above, note 155.

¹⁶² This was, admittedly, before the current legislation had been released, and was based solely on the provisions of the AUSFTA. See, Standing Committee on Legal and Constitutional Affairs, above, note 11, at 42.

¹⁶³ Brian Fitzgerald, Catherine Bond, Abi Paramaguru and Graham Greenleaf believe that the *Stevens v Kabushiki Kaisha Sony Computer Entertainment* (2005) 221 ALR 448 (HCA) result is made entirely redundant by the new access control TPM definition, because it so broad. This may mean that PlayStation protections will be considered TPMs. Similarly, Kimberlee Weatherall has opined that the CSS DVD protection will also be fully protected under Australian anti-circumvention law, despite its region coding elements. See, Fitzgerald, above, note 5; Bond, Paramaguru & Greenleaf, above, note 6, at 291; Weatherall (2006), above, note 155.

s 10.¹⁶⁴ This issue will not affect the economic analysis conducted below; it will only affect the types of measures that these results may be applied to.

But whether the DVD and PlayStation TPMs are excluded or not, the DVD Shrink software is characteristic of free, software-based circumvention devices provided online, as are PlayStation mod-chips of other hardware-devices which require installation and allow multiple infringements. So regardless of whether or not these specific protections are considered TPMs under s 10, they and their circumvention devices are representative of others in the market that could fall within this definition.¹⁶⁵ The results for these examples will, therefore, still contribute to the body of knowledge on the application of anti-circumvention laws.

¹⁶⁴ Moreover, four examples are given. So even if the first two examples are excluded from Australian anti-circumvention law protection, the results from the final two examples will remain applicable.

¹⁶⁵ For example, the TPM that protects HD-DVD movies is not dissimilar to CSS, and the PSP TPMs parallel well with those of the PlayStation 2; and neither of these systems contain region-coding elements. But the PlayStation 2 and DVD protection systems are selected as, unlike the alternatives, they are already well established in their markets, and there is a considerable amount of information available on them.

[3.2] The Values for the Models – Provider Model

Here are the figures for the current Australian situation.

Values Table 1

PROVIDER	B _{PSYCH}	B _{FINC}	C _{TECH}	C _{TRANS}	C _{TIME}	C _{AC-LAW}				U _{DEAL}	Will Provide?
						p _{CRIM}	C _{AC-CRIM}	p _{CIVIL}	C _{AC-CIVIL}		
1. DVD Shrink	2	0	0.00	0.00	0.025	0.00%	0.00	0.001%	360	1.971	YES
2. Mod-chip	0.01	110	14.13	0.00	19.53	0.01%	307,875.00	1.00%	96	45	YES
3. ProBuster	0.01	20	0	0.024	0.43	0.001%	270,375.00	0.005%	180	17	YES
4. Crackman	0.01	60	20	5	15.63	0.01%	232,875.00	0.10%	700	-5	NO

These values will now be explained.

[3.2.1] *Psychological Benefits (B_{PSYCH})*

The psychological benefits of providing are very uncertain and are extraordinarily difficult to monetise. They will not play a large role in the utility equations of commercial providers, but will be fundamental to an analysis of the non-commercial provider.

The commercial provider will, typically, supply circumvention devices and services, solely to reap the monetary rewards that can result. The non-commercial provider, on the other hand, will not make any financial benefit, and will likely lose money by providing. These providers still choose to

provide, purely because of the intangible psychological benefits that they gain from doing so.

So, the small, but noticeable, figure of \$0.01 is taken for the B_{PSYCH} variable of commercial providers.¹⁶⁶ These providers will likely appreciate some of the psychological benefits associated with underground community accolades and peer support. Such benefits will be very small per device, but still exist and thus must be represented in some form.

As B_{PSYCH} is so critical to non-commercial provider utility, and is very difficult to quantify, an accurate judgment cannot be made on its size for these participants. Instead, a range of B_{PSYCH} values have been processed through the model, in order to illustrate the effects of anti-circumvention laws on the utilities of all non-commercial providers; be their benefits high or low.

[3.2.2] *Financial Benefits (B_{FINC})*

The financial benefits of providing will be zero for non-commercial providers, but will be the price charged per circumvention device, for commercial providers.

¹⁶⁶ This variable is also valued at a very low level to favourably portray the effects of anti-circumvention laws. If the benefits of providing are lower, anti-circumvention laws will appear to have a proportionately greater effect.

The results that follow are based on ranges of device prices (B_{FINC}), to illustrate how anti-circumvention laws affect this variable, market wide. However, some real-world figures are presented here, to give perspective on the results and to allow an assessment of what prices are extreme and what prices are realistic.

USER	<i>1. DVD Shrink</i>	<i>2. Mod-chips</i>	<i>3. ProBuster</i>	<i>4. Crackman</i>
B_{FINC}	\$0	\$110	\$20	\$60

The price of \$110 for a PlayStation 2 mod-chipping service is taken from the website of a local Sydney provider.¹⁶⁷ The figures of \$20 and \$60 are simply reasonable estimates of how much could be charged for the ProBuster and Crackman circumvention devices, relative to their original product prices.

[3.2.3] *Technological Costs (C_{TECH})*

The technological costs include the cost of the circumvention device to the provider, as well as the cost of the implements used to install or ready it for sale. Where implements or tools can be used to provide multiple devices, their cost is distributed among the number of devices sold.

¹⁶⁷ Consoletronics, 'PS2 Xbox Modchip Specialist in Sydney' <<http://www.consoletronics.com>> (2 Aug 2007).

For the vast majority of software-device providers, technological expenses will be sunk costs.¹⁶⁸ If the providing activity requires a PC, the provider will need computer skills and thus must have some pre-existing technology-base. If the provider has a PC already, then no further resources must be invested in order to provide, and the C_{TECH} variable will be equal to zero.

The DVD Shrink and ProBuster providers have PCs already, and are taken to have acquired their devices for free.¹⁶⁹ Therefore, their C_{TECH} variables equal zero.

The technological costs of the Crackman provider are limited to the wholesale price of the dongle, which is \$20. This figure is estimated based on the manufacturer's cost of producing a self-enclosed hardware device and transporting it to the provider.¹⁷⁰

¹⁶⁸ A sunk cost is a cost that has already been incurred. These are not considered in the rational individual's calculation, because they will be incurred, regardless of whether the individual chooses to contravene or not.

¹⁶⁹ DVD Shrink could be acquired from any number of online sources, and the ProBuster provider is taken to acquire the first device from a peer in that provider's underground hacking group. Acquiring a commercial software device, like ProBuster, will not always be free. But introducing a one-off cost, to be divided among the many thousands of devices provided, would have little to no effect anyway.

¹⁷⁰ As the mod-chip costs just less than \$14, and it has a similar algorithm-output function, the wholesale price of the Crackman should be comparable. However, because the Crackman device is external to the PC, it requires greater protection from knocks and heat, and it also needs a male USB connector. These additions will likely make the Crackman dongle roughly 50% more expensive to manufacture, than the PlayStation 2 mod-chip. This gives a Crackman wholesale price estimate of about \$20.

The mod-chip provider's technological cost includes the cost of the mod-chip and the cost of a soldering iron that is needed to install the chips. The mod-chip that is installed by the provider costs just less than \$14.¹⁷¹ A simple electric soldering iron can be shipped, with solder, for \$25.¹⁷² It is assumed that this iron will burn out after about one year, and a new one will be needed, so this \$25 cost is divided among the number of chips installed each year. This mod-chip provider is taken to install 4 mod-chips per work-week, which total to 192 chips per year. Therefore the mod-chip provider's technological cost per device is the \$14 chip cost plus the per installation tool cost of \$0.13, which amounts to \$14.13 in total.

[3.2.4] *Transmission Costs (C_{TRANS})*

The transmission costs will depend on the nature of a provider's business. Physical premises will add rent expense to the C_{TRANS} variable, and webpages will add hosting and upload costs.

¹⁷¹ The major chips in the market are the Modbo750, Messiah750 and Duo2 chips, which each cost just less than \$14.¹⁷¹ Consoletronics, 'Mod-chip' <<http://www.consoletronics.com/modchip.html>> (9 Sep 2007).

¹⁷² This package includes the price of solder and shipping costs. See, eBay, 'eBay Australia – Soldering Iron' <http://search.ebay.com.au/soldering-iron_W0QQ_trksidZm37QQfromZR40QQfsooZ1QQfsopZ3QQsbrsrtZl> (9 Sep 2007).

The provider in example 2 does incur rent expense from the sales location, but this provider only provides a mod-chipping service to generate additional income for the current electronics repair business. This means that the rent and utilities expenses of the sales location will be incurred regardless of whether or not the individual provides. This makes them sunk costs, which should not be factored into the equation. Therefore, the mod-chip provider is given a C_{TRANS} value of zero.

On the other hand, if providing is done as an entire occupation, and no other services are provided, then rent expense should be included in the transmission cost variable. So, the example 4 Crackman provider's transmission cost will include the stall rent. The rent for a half-table at the markets is \$100 per week, during which time, this provider sells 20 devices.¹⁷³ Therefore, the transmission cost per device is \$5.

The DVD Shrink provider has a transmission cost of zero. This provider simply uploads the device to peers on a Bit Torrent network; which costs

¹⁷³ This is based on half of the price of a regular 3 by 3 meter stall at Fairfield Markets. This market is only open on Saturdays, and charges \$50 per day per stall. So assuming that the market were open four days a week, and the provider shares the stall evenly with the neighbouring pirate software seller, the stall rent would be \$100 per week. This specific market was chosen for pricing, as it is the type of market where a provider could keep a low profile and best avoid detection. Many copyright infringing items, like infringing t-shirt prints, are sold at this type of market so it is probably the safest public sales venue for this provider.

nothing, as the provider already has an iiNet broadband connection that does not charge any excess for uploads.¹⁷⁴

As the ProBuster provider supplies the devices online, his or her transmission costs will be low, but will still include the costs of domain and web hosting, that are necessary to keep the download website available. The ProBuster device only requires 5 megabytes of storage space, so only a very basic, \$2.42 per month, hosting plan is warranted.¹⁷⁵ It also costs the provider \$6 per year to register and retain the domain name 'http://www.probusteraustralia.info'.¹⁷⁶ This comes to a grand total of \$35.04 per year, which is divided among the 1,460 devices sold, to give a transmission cost of \$0.02 per device. This ProBuster provider also advertises through an eBay account, and charges through a related PayPal account; however both of these services are free.¹⁷⁷

¹⁷⁴ iiNet, 'Broadband Plans' <<http://www.iinet.com.au/products/broadband/plans.html>> (31 Aug 2007). Note that Bit Torrent is strictly peer to peer transferring, with no central location. Peers locate each other through the tracker server, but once other peers are located the tracker is no longer necessary.

¹⁷⁵ MD Web Hosting, 'Budget Hosting' <<http://www.mdwebhosting.com.au/webhosting/budget/?a=true&gclid=CMfH5v2BtY4CFR2GhgodESbnxw>> (9 Sep 2007).

¹⁷⁶ Crazy Domain Names Australia, 'Crazy Domains, Australia - Domain Name Registration' <<http://www.crazydomains.com.au/>> (9 Sep 2007).

¹⁷⁷ eBay, 'eBay Australia – Registration: Enter Information' <https://scgi.ebay.com.au/ws/eBayISAPI.dll?RegisterEnterInfo&_trksid=m37> (9 Sep 2007).

[3.2.5] *Time Cost of Providing (C_{TIME})*

The time cost of providing is calculated by multiplying the hours taken to provide a single circumvention device, with the hourly rate of alternate income-generating activities. This rate may represent the income that could otherwise be realised from the provider's other job, if only providing part-time, or the income from a potential job that the provider is qualified for.¹⁷⁸

This C_{TIME} variable represents the opportunity cost of providing, and introduces a reasonable return for labour prerequisite, which ensures that providing is worth the provider's time.¹⁷⁹

The salary figures given in the examples, range from \$30,000 to \$50,000 per year, depending on the expertise of the provider. These figures are then used to value the time taken to provide.

Anyone can sell a dongle at a market, as this requires no special knowledge or qualification. So an alternative occupation for the Crackman provider would only render the individual's time worth \$30,000 per year, or \$15.63 per

¹⁷⁸ This variable is added on the assumption that the time spent providing could otherwise be spent earning financial benefits from another source.

¹⁷⁹ While this is considered an opportunity cost, for an economic analysis, this is considered an element of profit in accounting terms. However, this time cost element is necessary as it factors in the income-generating alternatives that a contravener is faced with.

hour.¹⁸⁰ This provider sells dongles at the market for 5 hours a day, 4 days a week, and sells 20 devices in this period. Therefore, the total time cost per week of \$312.60 is divided by the 20 devices sold, to give a per device time cost of \$15.63.

A mod-chip provider, on the other hand, must have some skill and electronics know-how in order to install and test the chips properly. This would indicate that this type of provider would be qualified for an alternative electronics job which would pay \$50,000 a year, or \$26.04 per hour.¹⁸¹ It takes the provider 45 minutes to install and test a PlayStation 2 mod-chip, and therefore the time cost per device is \$19.53.¹⁸²

¹⁸⁰ Per hour rates are calculated based on a work day of 8 hours, a work week of 5 days, and a work year of 48 weeks. Therefore: $\$30,000/48/5/8 = \15.63 . The estimations for unskilled sales are based on figures from the Australian Bureau of Statistics, which indicate that the average weekly total cash earnings of a full-time, non-managerial, adult, retail worker, is \$769.40. This equates to \$19.24 per hour and \$36,931 per year. The salary levels taken for these examples vary from \$30,000 to \$45,000. The salary is estimated, within this range, depending on the skill required to provide. See, Australian Bureau of Statistics, 'Cat. No. 6306.0 Employee Earnings and Hours, Australia, May 2006 - Table 13 Average Weekly Total Cash Earnings' <[http://www.ausstats.abs.gov.au/ausstats/subscriber.nsf/0/02B3A1D0C7BDE744CA25728F0016B5E1/\\$File/6306013.xls](http://www.ausstats.abs.gov.au/ausstats/subscriber.nsf/0/02B3A1D0C7BDE744CA25728F0016B5E1/$File/6306013.xls)> at cell D51 (9 Sep 2007).

¹⁸¹ This estimation is based on figures from the Australian Bureau of Statistics, which indicate that the average weekly total cash earnings of a full-time, non-managerial, adult, manufacturing industry worker, is \$1,025.10. This equates to \$25.63 per hour and \$49,205 per year. The \$50,000 yearly salary, selected for use in the models, is the rounded figure. See, Australian Bureau of Statistics (2006), above, note 180, at cell D47.

¹⁸² The information regarding the duration of the chip installation process was acquired by contacting a mod-chip provider in Bankstown. See, Consoletronics, 'PS2 Xbox Modchip Specialist in Sydney' <<http://www.consoletronics.com>> (2 Aug 2007).

The online ProBuster provider needs more skill than the Crackman provider; as a website must be created and maintained; but does not need the technical training of a mod-chip provider. Therefore, this provider is taken to provide part-time, while working full-time for \$40,000 per year, or \$20.83 per hour.¹⁸³ It takes this provider 18 hours to set up the download website, plus 1 hour each month to maintain the site and payment systems. So the total time cost is \$624.90 per year, which is allocated to the devices equally, to give a per device time cost of \$0.43.

The DVD Shrink provider needs only a limited level of internet and technological capability to upload the software-device on a Bit Torrent network. So the full-time job of this part-time provider is taken to pay \$35,000 per year, or \$18.23 per hour.¹⁸⁴ It takes the provider 30 minutes to create a torrent file, enlist a torrent tracker and start uploading DVD Shrink on the Bit Torrent network.¹⁸⁵ So the total time cost is \$9.11. This is a one-off cost, so it is divided among the 365 devices provided per year, to give a per device time cost (C_{TIME}) of \$0.025.

¹⁸³ This provider is taken to have an occupational aptitude directly between those of the mod-chip provider and the Crackman provider, and is thus paid the average salary of the two.

¹⁸⁴ This provider's occupational aptitude is set between the ProBuster and Crackman suppliers. So this provider's time is valued at the average rate of the two.

¹⁸⁵ A tracker is a server that must be accessed by downloaders, to acquire data regarding peers (other downloaders) and seeders (providers), so that the downloader may connect to those participants. Without a tracker, downloaders will not be able to locate peers who are sharing the DVD Shrink software, and will therefore be unable to download.

[3.2.6] *Criminal Punishment Cost (C_{AC-CRIM})*

The quantum of copyright law criminal penalties is notoriously difficult to predict, so no accurate method could be developed for this investigation. However, as the model is used to illustrate the ineptness of anti-circumvention laws, an unrealistically high figure shall be taken for the criminal cost of punishment variable, to present the effects of anti-circumvention law favourably.

The expected provider punishment will be taken as 75 per cent of the maximum punishment possible. This figure is unrealistically high, as typical copyright cases result in 'low-end' punishments, and it is quite rare that an offender is punished with the maximum penalty and prison sentence.¹⁸⁶

Both the dealer and service provider offences, under ss 132APD and 132APE, have a maximum penalty of 5 years in jail and 550 penalty units. According to s 4AA of the *Crimes Act 1914* (Cth), one penalty unit is equal to \$110, so the maximum pecuniary penalty to be imposed is \$60,500. The cost of being in prison is calculated using the following table.

¹⁸⁶ See generally, Kendall & McNamara, above, note 12.

Penalty	Yrs in Prison	Opportunity Cost	Inconvenience Cost	Maximum Punishment Cost
60,500	5	Salary × Yrs in Prison	Inconvenience Cost × Yrs in Prison	Penalty + Opportunity + Inconvenience

Consistent with Becker's theory, both the income foregone and the inconvenience associated with prison time are considered.¹⁸⁷ The salary value is explained in the C_{TIME} section above.¹⁸⁸

The inconvenience cost represents the discomfort and loss of liberty suffered by the imprisoned offender. As this is based on individual preference, and is rather unquantifiable, any monetisation of the inconvenience cost can only be arbitrary.

The inconvenience cost should reflect the amount an individual would pay to stay out of prison, given that salary-related opportunity costs had already been dealt with. This figure is taken as \$20,000 per year, for each individual. This may be a moderate or an excessively high figure, depending on the user. However, any discrepancy in this figure is more than overwhelmed by the extreme values attributed to the other anti-circumvention law variables.

¹⁸⁷ Becker, above, note 15, at 179-180.

¹⁸⁸ See section 3.2.5 at page 84 above.

[3.2.7] *Civil Punishment Cost ($C_{AC-CIVIL}$)*

Under s 116AQ(1), a civil action could result in an injunction, an order to destroy a given device, and damages or an account of profits. Only the final two remedies will be considered, as they can be quantified monetarily.¹⁸⁹

[3.2.7.1] *DAMAGES OR ACCOUNT OF PROFITS?*

There are two competing factors that will affect a copyright owner's choice of remedy; firstly, the potential quantum of the remedy and, secondly, the provability of this quantum.

Quantum

In the context of producing relatively cheap consumer-level digital products, an individual's act of providing circumventive capability will generally cause greater damage to a copyright owner, than it will cause benefit to the provider.¹⁹⁰ This arises from the low marginal cost of reproducing digital

¹⁸⁹ An injunction or an order to destroy the provider's stock of circumvention devices, will be the least of a provider's concerns, as far as remedies go. Moreover, the financial ramifications of these orders will generally be rather meager, after being multiplied with the provider's p , so they will not seriously affect the model.

¹⁹⁰ If an original product costs \$100, for example, a circumvention device will probably not be feasible if it costs more than \$50, considering that an illegal copy of the software must also be acquired. Because digital copyright content can be very cheaply reproduced, the copyright owner will appreciate at least a \$50 profit, from the sale of one original

content, and will usually make a remedy of damages more appealing to a copyright owner than an account of profits.

Provability

On the other hand, it is very difficult to predict the compensatory element of the damages remedy, as a provider does not infringe copyright personally, but may allow another person to infringe. It may thus be troublesome for the copyright owner to prove that a particular loss is a direct result of a provider's activities.

Indeed, proving actual loss may not even be possible when considering circumvention devices which have non-infringing uses or allow uses that would not result in lost sales. For instance, the DVD Shrink and mod-chip circumvention devices can be used to make backup copies, or to use legitimate, foreign-bought products, which are not available in Australia.¹⁹¹ These uses will not result in lost local sales, so these devices do not always cause damage to the copyright owner in this way.

product. So, even in the extreme case, it appears that the lost profit, or damage, caused to the copyright owner is \$50, while the profit made by the provider is necessarily less than \$50, as this is the maximum device sales price. This figure will necessarily be reduced below \$50 by the provider's costs, and will thus be less than the damage caused to the copyright owner.

¹⁹¹ Furthermore, mod-chips can improve the performance of the PlayStation 2 console, by allowing the operation of home-made applications and games. See, Consoletronics, 'PS2 Xbox Modchip Specialist in Sydney' <<http://www.consoletronics.com>> (13 Oct 2007).

Damages may be equally difficult to prove for devices which permit the infringement of more than one work. In this case, the actual number of lost sales caused by the use of the device would be wholly unquantifiable, as would the compensatory damages; and without evidence of actual loss, a copyright owner will not be allowed compensation.

It will often be far easier to prove and quantify an account of profits remedy, as the provider's revenues and costs can be investigated and presented as reliable evidence to a court.

[3.2.7.2] DAMAGES

Section 116AQ stipulates that the remedy of damages includes both compensatory and punitive elements. The magnitudes of these elements will be dealt with separately, below.

Unfortunately, there is a lack of Australian case law that illustrates how anti-circumvention law remedies and penalties will be determined in an Australian courtroom. This means that, in order to accurately predict the civil

punishment cost, the traditional copyright case law must be analysed and applied to anti-circumvention laws.¹⁹²

Compensatory Damages

Compensatory damages are designed to provide recompense to the copyright owner, to offset any loss caused by a contravention.¹⁹³ They are to include the profits lost by the copyright owner, not the gross revenue; as manufacturing and distribution costs guarantee that the copyright owner will not gain this full amount for each unit sold.¹⁹⁴

The profit on any digital copyright product could not exceed the total price, but would probably be quite high, because of the low marginal cost of replicating digital works. So, considering the extreme case, the profit margin is taken at 80 per cent of the original product price.

This is a very high percentage, and is not representative of every IP product's profit margin. But, it is high enough to encompass the vast majority of

¹⁹² When quantifying copyright infringement damages, a distinction can be made between the infringing and the non-infringing content of the product sold, in order to reduce the quantum of the remedy. However, a circumvention device will be the contravening item, as a whole, so no real reduction can be given for a non-contravening element of the device. See, *Norm Engineering v Digga Australia* (2007) 72 IPR 332, para 297-298 (FCA).

¹⁹³ *Norm Engineering v Digga Australia* (2007) 72 IPR 332, paras 291-294 (FCA).

¹⁹⁴ *Ibid.*

copyright products sold in Australia, and errs on the side of caution, to favourably depict the effects of anti-circumvention laws.

Additional Damages

Under s 116AQ(2), damages awarded as part of a civil remedy may include additional payments, over and above the damage that has actually been proven for the purpose of compensation.¹⁹⁵ Additional damages are far more difficult to predict than those for compensation because, in the words of Wilcox J, 'any assessment must be arbitrary, in the sense that it is impossible to demonstrate [their] correctness by reference to provable fact'.¹⁹⁶

Because of their arbitrary nature, and the lack of Australian cases involving anti-circumvention law, s 116AQ(2) additional damages may only be predicted by paralleling them with the application of the equivalent provision for traditional copyright infringement, s 115(4).¹⁹⁷ While the process of quantifying these additional damages for copyright infringement is also

¹⁹⁵ See s 116AQ(2).

¹⁹⁶ *Autodesk Australia Pty Ltd and Another v Cheung* (1990) 17 IPR 69, 78 (FCA). This case involved copyright infringement, not a breach of anti-circumvention law. However, Wilcox J was making a general reference to the difficulty of justifying the quantum of additional damages.

¹⁹⁷ Section 115(4) deals with additional damages awarded for traditional copyright infringements.

necessarily imprecise and unpredictable,¹⁹⁸ the case law can still give some limited guidance as to the most likely quantum.

Regrettably, there are absolutely no rules, or even trends, that may associate the quantum of additional damages with the quantum of compensatory damages. Additional damages can be zero, or quite low, compared to the compensatory payments; as in *Namol Pty Ltd v AW Baulderstone Pty Ltd*, where the additional damages were only 43 per cent of the compensatory payment.¹⁹⁹ However, in the case of *Raben Footwear Pty Ltd v Polygram Records Inc*, additional damages of 55 times the compensatory amount were upheld on appeal, as they were not considered excessive.²⁰⁰ So if such a huge figure can be considered adequate by more than one judge, it would be inaccurate to conclude that additional damages will never greatly exceed the compensatory payments.²⁰¹

As was alluded to earlier, additional damages are designed to be, at least partly, punitive; and so will be largely dependent on the whim of the

¹⁹⁸ *Bailey v Namol Pty Ltd* (1994) 125 ALR 228, 229, 239 (FCA); *Fenning Film Service Ltd v Wolverhampton, Walsall and District Cinemas Ltd* [1914] 3 KB 1171, 1174 (KBD).

¹⁹⁹ (1993) 27 IPR 1 (FCA); The compensatory damages were \$350,000 and the additional damages were \$150,000.

²⁰⁰ (1997) 145 ALR 1, 17 (FCA); the compensatory damages were \$275 and the additional damages were \$15,000.

²⁰¹ This point is supported by *Raben Footwear v Polygram Records Inc*. (1997) 145 ALR 1, 6, 15-16 (FCA).

presiding judge.²⁰² But considering the profits made by commercial providers, and the enhanced need for deterring future contraventions, their additional damages may sit at the high end of the spectrum. As noted by Conti J, with regard to additional damages for infringement; ‘it is a matter of importance for the Court to deter commercial operations of an infringing nature conducted on a wide ranging scale’.²⁰³ This is not to say that non-commercial providers will not be required to pay additional damages; but rather that their additional damages will be lower than those of their commercial counterparts.

So, with little guidance from the existing anti-circumvention and copyright case law, a reasonable but somewhat arbitrary approach must be taken to quantifying the s 116AQ(2) additional damages element. It seems reasonable, with reference to Australian cases regarding additional damages for infringement,²⁰⁴ to consider the s 116AQ(2) additional damages for commercial providers to be equal to 150 per cent of the compensatory

²⁰² *Milpurrruru v Indofurn Pty Ltd* (1994) 30 IPR 209, 348-349 (FCA).

²⁰³ *Microsoft Corporation v PC Club Australia Pty Ltd* (2005) 148 FCR 310, para 281 (FCA).

²⁰⁴

Case	Compensatory Damages	Additional Damages	Additional / Compensatory
<i>Namol Pty Ltd v AW Baulderstone Pty Ltd</i> (1993) 27 IPR 1	\$350,000	\$150,000	42.86%
<i>Milpurrruru v Indofurn Pty Ltd</i> (1994) 54 FCR 240	\$120,000	\$70,000	58.33%
<i>Microsoft Corporation v Goodview Electronics Pty Ltd</i> (2000) 49 IPR 578	\$625,035	\$500,000	80.00%
<i>Microsoft Corporation v Atifo Pty Ltd</i> (1997) 38 IPR 643	\$24,000	\$20,000	83.33%
<i>Microsoft Corporation v Ezy Loans</i> (2004) 63 IPR 54	\$240,625	\$350,000	145.45%
<i>Microsoft Corporation v TYN Electronics Pty Limited (in liq)</i> (2004) 63 IPR 137	\$386,000	\$700,000	181.35%
<i>Autodesk Australia Pty Ltd and Another v Cheung</i> (1990) 17 IPR 69	\$15,000	\$35,000	233.33%
<i>Raben Footwear Pty Ltd v Polygram Records Inc and Anor</i> (1997) 145 ALR 1	\$275	\$15,000	5454.55%
<i>Microsoft Corporation v Glostar Pty Ltd</i> (2003) 57 IPR 518	\$4,375	\$291,625	6665.71%

element, or 120 per cent of the original product price.²⁰⁵ The equivalent for non-commercial providers will be 50 per cent of the compensatory element, or 40 per cent of the original price, as their offenses are at the low end of the spectrum of heinousness.²⁰⁶ As explained above, these are not, and could not be, derived from any set rules. However, given the relevant case law, they seem sensible figures.²⁰⁷

Total damages, comprising both the compensatory and punitive elements, will therefore equal 200 per cent of the original product price for commercial providers, and 120 per cent for non-commercial providers.

[3.2.7.3] *ACCOUNT OF PROFITS*

If damages cannot be proven, then a copyright owner may choose an account of profits remedy. This would involve the provider returning, to the copyright owner, any profits made from his or her illegal providing activities. Provider profit is calculated by subtracting the costs of providing (C_{DEAL}) from the device price (B_{FINC}). The time cost of providing will not be removed from the

²⁰⁵ Recall from the investigation above, that compensatory damages will be taken as 80 per cent of the original product price. Therefore, 150 percent of this figure gives 120 per cent of the original price as the quantum of additional damages.

²⁰⁶ See note 204 above.

²⁰⁷ See note 204 above.

provider revenue, as this is, by accounting standards, a measure of the profit reaped by the provider, rather than a cost.

[3.2.7.4] *THE CHOICES*

Suing DVD Shrink Providers

The DVD Shrink software has uses which do not cause lost sales and it allows multiple DVD movies to be copied, so the compensatory damages would be rather unquantifiable. This would make a damages remedy very difficult to prove.

However, as DVD Shrink is provided non-commercially, an account of profits remedy would be fruitless. So a damages remedy would have to be sought, difficult though it may be. To emphasise the effect of anti-circumvention laws, the DVD Shrink provider's liability, per device sold, is taken to extend to the 10 DVDs copied by the user.²⁰⁸

²⁰⁸ This will include both the compensatory and the additional damages calculated above. As explained earlier, this DVD Shrink value is far beyond the realm of realistic punishments. Firstly, the ten lost sales probably could not be proven, and secondly, it would be unlikely that the provider would be forced to compensate for the whole loss. However, to favourably predict the impact of anti-circumvention laws, this extremely large $C_{AC-CIVIL}$ figure is accepted.

Suing Mod-chip Providers

Like DVD Shrink, the mod-chip devices may have legitimate purposes, and it may be very difficult to quantify the profits lost as a result of the sale of one mod-chip. So a copyright owner might try to seek an account of profits when suing providers of these devices.

The mod-chip provider's profit will equal the sales price less the cost of the mod-chip, the soldering iron and the solder used to install the chip.²⁰⁹ In other words, the civil punishment cost ($C_{AC-CIVIL}$) will be equal to B_{FINC} less C_{TECH} . The court will likely attribute the sunk costs of the provider, like store rent, to the legal electronics repair operations, and will not consider them specific to the contravening activities.

Suing ProBuster and Crackman Providers

The ProBuster and Crackman devices do not have any non-infringing uses, and would only ever be acquired to use illegal versions of DesignPro or CADman.

²⁰⁹ As explained in note 179 above, the C_{TIME} variable is not included in the profit calculation, so these are the only providing costs incurred by the mod-chip provider.

Furthermore, the lost sales they cause would be more quantifiable, as one device sold will, at most, result in one lost sale.²¹⁰ So the Crackman and ProBuster providers will likely be sued for damages, as this remedy will be greater than an account of profits, and will still be quantifiable. The damages calculated for these examples will be based on the single sale lost by the copyright owner.²¹¹

[3.2.8] *Probability of Being Punished ($p_{AC-CRIM}$ & $p_{AC-CIVIL}$)*

An individual's perceived probability of being punished in the future will be dependent on enforcement rates in the past. But Australia has not had a single successful anti-circumvention prosecution yet, so the perceived probability should be almost zero. However, to avoid the under-representation of anti-circumvention law effects, the predicted actual enforcement rates will be used in the models.²¹² These figures will be predicted using tables of probability of punishment over time.²¹³

²¹⁰ The loss is *at most* one lost sale, as econometric studies into digital piracy have indicated that one copy does not always result in one lost sale. See note 34 above.

²¹¹ This liability will extend to both compensatory and additional damages.

²¹² A negligible p value would indicate that individuals do not even consider anti-circumvention law punishments in their utility estimations. This is not true. Although, the laws are still very new and individuals are yet to understand the full gamut of the prohibitions and penalties, there remains a serious threat looming in the future.

²¹³ See the appendix on page 181.

The probability tables in the appendix illustrate how the model takes into account the increased probability of punishment when contraveners operate on a large scale.²¹⁴ As the number of contraventions performed in a given period increases, so too will the probability of being caught and punished in that period.

For example, a mod-chip provider will have a per contravention p value of 0.01 per cent for criminal punishment and 1 per cent for civil punishment.²¹⁵

While these seem like very low figures, they are incredibly large for each single offence, when compounded over an extended period. A mod-chip provider who sells 192 chips per year, and has a 0.01 per cent per offence probability, will have a yearly probability of being punished of 1.90 per cent. This is nearly a one in fifty chance of facing criminal conviction in a year. Similarly, the 1 per cent per contravention figure for civil action produces a giant yearly probability of punishment of 85.48 per cent for the same mod-chip provider. These are huge figures, considering the fact that there are many mod-chip providers in Australia,²¹⁶ and yet there has only ever been

²¹⁴ Ibid.

²¹⁵ The civil probability ($p_{AC-CIVIL}$) is greater than the criminal probability ($p_{AC-CRIM}$) for the reasons outlined in section 3.2.8.1 on page 101 above.

²¹⁶ See, Consoletronics, 'PS2 Xbox Modchip Specialist in Sydney' <<http://www.consoletronics.com>> (2 Aug 2007); 'Xbox 360 Mods & Upgrades' <<http://cracker.com.au/classifieds/sydney/for-sale/videogames/274509058.aspx>> (31 Aug 2007); 'PS2 Xbox Wii Xbox 360 Mods Repairs and Upgrades (Frenchs Forest)' <<http://cracker.com.au/classifieds/sydney/for-sale/videogames/306271607.aspx>> (31 Aug 2007); 'Australia's Leading Repairs Specialist XBOX360 Wii (BALMAIN)'

one Australian mod-chip case, which was a civil action and was unsuccessful.²¹⁷ However, these high figures are used to test the validity of this thesis, even after adopting a favourable view of the effectiveness of anti-circumvention laws.

The $p_{AC-CRIM}$ and $p_{AC-CIVIL}$ values per contravention and per year are tabled below.²¹⁸

PROVIDER	Devices per Year	$p_{AC-CRIM}$	Yearly $p_{AC-CRIM}$	$p_{AC-CIVIL}$	Yearly $p_{AC-CIVIL}$
1. DVD Shrink ²¹⁹	365	0.000%	0.00%	0.001%	0.36%
2. Mod-chip	192	0.010%	1.90%	1.000%	85.48%
3. ProBuster	1460	0.001%	1.45%	0.005%	7.04%
4. Crackman	960	0.010%	9.15%	0.100%	61.73%

[3.2.8.1] CIVIL V CRIMINAL

The civil probability exceeds the criminal probability because of the relative difficulties in proving criminal cases, and acquiring resources to fund them.

Criminal actions may only be taken by the Australian Federal Police (AFP) or

<<http://cracker.com.au/classifieds/sydney/for-sale/videogames/304843097.aspx>> (31 Aug 2007); 'Premods, Repairs, Installs, Modchips (Bankstown)'
<<http://cracker.com.au/classifieds/sydney/for-sale/videogames/299830816.aspx>> (31 Aug 2007).

²¹⁷ See, *Stevens v Kabushiki Kaisha Sony Computer Entertainment* (2005) 221 ALR 448 (HCA).

²¹⁸ Compare these provider p values with the user p , calculated in section 3.4.7, of 0.000091 per cent. It makes sense that the user p is significantly lower than the provider p . Providers are more likely to be punished because their contraventions are more heinous, they are significantly more detectable, they arguably permit many infringements and some of them offend for commercial benefit.

²¹⁹ As will be explained in section 4.2.1, at page 132, non-commercial providers are not subject to criminal punishment under Australia's anti-circumvention laws. Therefore, the DVD Shrink provider's probably of being punished for a criminal offence ($p_{AC-CRIM}$) is zero.

the CDPP,²²⁰ and it is only an efficient use of limited federal resources to investigate and prosecute the most heinous and active large-scale pirates and providers.²²¹ Also, criminal actions typically require more in-court hours and more evidence, as they must be proven beyond a reasonable doubt.²²² Moreover, the criminal sections 132APD and 132APE require the prosecution to prove that the providing was done 'with the intention of obtaining a commercial advantage or profit',²²³ whereas the civil sections, 116AP and 116AQ, require nothing of the sort. So the criminal probability ($p_{AC-CRIM}$) is lower because; it is less likely that action will be taken by authorities, there is more to be proven and there is a higher onus of proof.

Furthermore, while a copyright owner must invest private funds into a civil action, substantial returns may be gained, unlike in a criminal action, where no compensatory or pecuniary payments are made to the aggrieved party.²²⁴

²²⁰ The Office of the Commonwealth Director of Public Prosecutions (CDPP).

²²¹ See, Kendall & McNamara, above, note 12, at 131; Nguyen K, 'Aussie Software Pirate Extradited', *Sydney Morning Herald*, 7 May 2007: <<http://www.smh.com.au/news/technology/aussie-software-pirate-extradited/2007/05/06/1178390182639.html>> (13 July 2007).

²²² Under s 140 of the *Evidence Act 1995* (Cth), civil cases only require proof based on the balance of probabilities. However, criminal cases must be proven beyond a reasonable doubt, according to s 141 of the *Evidence Act 1995* (Cth).

²²³ While proving this may not be very difficult, when prosecuting commercial providers, doing so still requires further evidence and court time.

²²⁴ This point is important as providers can cause vast amounts of damage, which the copyright owner will want compensation for.

For these many reasons, civil actions have been the weapon of choice for copyright enforcement in the past. It is logical to conclude that a similar approach will be taken for anti-circumvention law enforcement, considering the advantages listed above and the similar difficulty of catching and prosecuting perpetrators.²²⁵

[3.2.8.2] *DIFFERENTIATING PROVIDER PROBABILITIES*

The online software-device providers have noticeably lower chances of punishment, because their medium of provision, the internet, allows anonymity and makes it easier to conceal activities, and thus elude detection and entrapment.²²⁶ Furthermore, it is possible for the provider to ‘re-locate’ for every contravention, by changing his or her Internet Protocol (IP) Address; unlike the hardware provider who remains at the same shop or stall. There are also programs than can mask the provider’s IP address, or show a fake one, to prevent the authorities from tracking them down. Moreover, even if the provider’s IP address is acquired, it is a long and difficult task to

²²⁵ It must be noted, however, that there have been few civil copyright cases in Australia, and even fewer successful criminal prosecutions. Copyright owners frequently find it too expensive to take civil copyright actions, and too difficult to collect money from defendants if they win. So they often refrain from outright legal action. Also, the Australian Federal Police have limited resources, and copyright enforcement is not of high priority, so few copyright offences are investigated and prosecuted. These issues together explain why, in reality, the probabilities of punishment will be lower than those used here. See, Kendall & McNamara, above, note 12, at 128, 131-134.

²²⁶ It is very difficult to detect traditional, physical copyright contravention, let alone online contravention. See, Kendall & McNamara, above, note 12, at 131.

determine the actual physical identity of the person at that IP address, and to locate and detain them.

When the software provided is free, like DVD Shrink, further factors reduce the probability of being punished. Firstly, if the device is free, popular and only 1.04 megabytes, like DVD Shrink, there will be countless providers, of varying sizes. These providers may operate publicly on an unsecured website, or they may operate through closed channels, sending devices in emails and on peer-to-peer networks. But regardless of their method, the sheer number of providers means that attacking a single individual would make little difference to the overall supply of devices, and thus would not be a financially-justified enforcement strategy. Furthermore, a copyright owner will likely focus on providers who provide commercially, and are making profits from their more heinous contraventions, as this difference will increase the potential damages that the owner may be awarded.

The probability figures vary among all of the examples because the providers have varying methods of providing, which means they have very different risks of detection. DVD Shrink providers are the least detectible as they provide online, with tens of thousands of others. ProBuster providers are slightly more detectible, as they require a fixed download website and may be personally identifiable through their payment channels. Crackman providers

are more detectable again, as they can be physically caught at the market stall; but can pack up and elude capture from week-to-week. And, finally, the mod-chip provider has the highest probabilities of punishment, as providing occurs at an electronics shop that cannot be closed down and moved, in a short time-frame. So while there is great disparity in the probabilities of punishment, there are equally great differences in circumstance.²²⁷

[3.3] The Values – User Buying Model

The following table lists the values in the U_{BUY} equation, for users who value the original product just highly enough to buy it.

Values Table 2

USER	V_o	P_o	C_o	U_{BUY}	Will Buy?
1. DVD Movies	32.38	30	2.38	0	YES
2. PS2 Games	62.38	60	2.38	0	YES
3. DesignPro	92.38	90	2.38	0	YES
4. CADman	352.38	350	2.38	0	YES

[3.3.1] Willingness to Pay (V_o)

As explained above, a user's V_o is the maximum amount, in dollar terms, that the user would be willing to pay for the original product.²²⁸ It will therefore

²²⁷ Moreover, all of the probabilities are extremely high. So even if they are not perfectly proportional to each other, these p values will all be far greater than the actual figures, and will thus accentuate the effects of anti-circumvention laws.

²²⁸ See section 2.3.2.1 at page 49 above.

dictate whether or not that user would have bought the original, if he or she had not chosen to circumvent and use the work illegally. If a user will buy, when deterred from illegal use, then serious benefits are reaped by copyright owners, in the form of reclaimed sales. However, if the user will not buy, even if deterred from his or her illegal activities, then little or no financial benefit is appreciated by copyright owners.²²⁹

The willingness to pay will vary greatly between individuals, so this analysis takes ranges of V_0 values, to represent the preferences of all users in the market. This allows the results to illustrate the effects of anti-circumvention laws on the market as a whole, and also to indicate which consumers will be driven to buy, circumvent or do neither.

²²⁹ This would indicate that there are no reclaimed sales, so no direct benefit would be realised by the copyright owner. It has been argued that the increased dissemination, associated with copying, increases product awareness and popularity, through a 'neighbouring' or 'network' effect. However, it could also be argued that the availability of the product, for free, could reduce the market's valuation (V_0) of the product. These arguments are both valid, but the degree of their application to digital copyright content is unclear at best. Therefore, their concepts seem too ambiguous to be inferred into the model. See, Oberholzer F & Strumpf K, 'The Effects of File Sharing on Record Sales: An Empirical Analysis' (2007) 115 *Journal of Political Economy* 1; Rochelandet & LeGuel, above, note 14, at 5; Takeyama, above, note 14; Barnejee A, 'A Simple Model of Herd Behaviour' (1992) 107 *Quarterly Journal of Economics* 797.

[3.3.2] *Original Price (P_o)*

The typical price of a single DVD movie is roughly \$30,²³⁰ while PlayStation 2 games average about \$60.²³¹ The DesignPro and CADman programs in examples 3 and 4 are priced at \$90 and \$350 respectively, based on the prices of similar products in their software category.²³²

[3.3.3] *The Cost of Acquiring an Original (C_o)*

To acquire an original product, typically a user has to travel to the retail outlet and return to their dwelling. This is really the only ancillary cost that is inflicted on the users in these examples.

The travel cost is calculated as an average of the public transport cost and the personal motor vehicle cost. The adult bus fare of \$1.70 each way, equals \$3.40 return, assuming that each original product purchase requires an additional

²³⁰ DVD Warehouse, 'Online DVD Store Australia' <<http://www.dvdwarehouse.com.au/>> (2 Sep 2007).

²³¹ Games Warehouse, 'Games Warehouse PlayStation 2 and PlayStation Games' <<http://www.gameswarehouse.com.au/psx.asp>> (2 Sep 2007).

²³² DesignPro represents products like Corel Painter Essentials 3, which retails for US\$79 (AU\$105). CADman is representative of programs like SmartDraw 2008, which retails for US\$297 (AU\$394), and also CADopia Standard 6, which is priced at US\$295 (AU\$330). See, Corel, 'Painting/Natural Media – Corel Painter Essentials 3' <<http://www.corel.com/servlet/Satellite/us/en/Product/1152105062012>> (9 Sep 2007); SmartDraw, 'Buy SmartDraw and Save \$100 Today' <<http://www.smartdraw.com/buy/>> (9 Sep 2007); CADopia, 'CADopia Online Store' <http://www.digitalriver.com/dr/v2/ec_Main.Entry?SP=10007&SID=36935&CID=0&DSP=0&CUR=840&PGRP=0&CACHE_ID=0> (9 Sep 2007).

trip to the shops.²³³ The cost of traveling in a personal motor vehicle would only be \$1.36 for a 10 kilometre return trip.²³⁴ So, the average is \$2.38.

This figure will be substantially smaller if the user has a more fuel economical personal vehicle,²³⁵ if shops are within walking distance, or if the user is permitted concessions by the public transport company.²³⁶ It may also be larger if an individual lives further than 2 bus sections or 5 kilometers from the required outlet. However, \$2.38 seems a reasonable, average travel price to reflect the majority of users.

²³³ The State Transit Authority of New South Wales, 'Sydney Buses: Prices' <<http://www.sydneybuses.info/tickets/prices.php>> (31 Aug 2007).

²³⁴ Petrol figures for the Holden Commodore are used, as it is the top selling Australian car. All other costs, including registration and insurance, are sunk costs and are not considered. The six-cylinder model consumes 10.9 liters of petrol per 100 kilometers. This equates to 0.109 liters per kilometer, and given the price of petrol is approximately \$1.25 per liter, the cost per kilometer is \$0.13625. This indicates that if the shops are 2 kilometers away it will cost \$0.55, if they are 5 kilometers away it will cost \$1.36 and if they are 10 kilometers away it will cost \$2.73 to travel to and from the shops by car. See, Australian Government Department of Transport and Regional Services, 'Quick Compare Web Form' <<http://www.greenvehicleguide.gov.au/GVGPUBLICUI/ApplicationFirstStartTaskWebForm.aspx>> (2 Sep 2007); GM Holden, 'Holden – Passenger: Commodore' <http://www.holden.com.au/pdf/chooseavehicle/techdata/GM_Holden_fuel_economy_VE.pdf> (2 Sep 2007).

²³⁵ The second most popular car is the Toyota Corolla, which only consumes an average of 7.55 liters of petrol per 100 kilometers (7.4 for manual and 7.7 automatic transmission). The petrol cost for this car would only be \$1.89, for a 10 kilometre round trip. See, Australian Government Department of Transport and Regional Services, above, note 234; Toyota, 'Toyota Australia: Corolla – Specifications' <<http://www.toyota.com.au/TWR/content/static/30108.pdf>> (2 Sep 2007).

²³⁶ This return bus fare would be reduced to \$1.60 for a concession ticket. See, The State Transit Authority of New South Wales, above, note 233.

[3.4] The Values – User Circumvention Model

Values Table 3 presents the figures in the U_{CIRC} equation, for users who value the original product just highly enough to buy it.

Values Table 3

USER	α	V_o	P_c	$C_{PARTNER}$	p	C_{LAW}	C_{ETHIC}	C_{VIRUS}	C_{DEVICE}	$C_{CIRC ETHIC}$	$C_{CIRC VIRUS}$	$C_{CIRC LAW}$	U_{CIRC}	Will Circumvent?
1. DVD Movies	0.67	32.38	0.50	9.88	0.000091%	36	0.05	0	6.15	0.05	0.01	12	5.06	YES
2. PS2 Games	0.67	60.00	0.50	6.38	0.000091%	72	0.05	0	6.24	0.05	4.13	24	24.45	YES
3. Design Pro	0.67	92.38	0.88	0	0.000091%	0	0.05	0	20	0.05	0.01	108	40.91	YES
4. CAD man	0.67	352.38	40	0	0.000091%	420	0.05	0.01	62.38	0.05	0.01	140	133.59	YES

[3.4.1] *Substitutability (α)*

Rafael Rob and Joel Waldfogel found, in their 2003 sample of college students, that individuals valued a downloaded music album at US\$10.66, while they valued a store bought album at US\$15.91.²³⁷ This would indicate that the substitutability (α) of file-shared mp3s for original music CDs, for college students in 2003, was 10.66 over 15.91; or 0.67.

This is not necessarily indicative of the preference of every individual for every IP product; however it does evidence a quantifiable reduction in value for copied products. This one-third loss of product value may be applied, as a

²³⁷ Rob & Waldfogel, above, note 32, at 44. This US\$15.91 value equates to approximately AU\$21.09.

rough guide, to other digital copyright content as there are similar losses in packaging and aesthetics, while the actual functionality is nearly identical.²³⁸

This figure is conservative, as a one-third loss is quite substantial, given the nature of digital content. The cause of TPM introduction, and legal protection, is the perfect replicability of digital copyright material. So it is fair to say, in this investigation, that the substitutability of copies for originals should be very high. This is because the essence of the product, its functionality, is often identical for a copy and an original, with only superficial differences distinguishing the products.²³⁹

Given this almost perfect replicability, 0.67 seems a reasonable value to superimpose upon other digital copyright products. If anything, this figure could be considered too low for the majority of consumer-level products.²⁴⁰

²³⁸ A user may value a downloaded album lowly, because they do not really like the music and would not have otherwise bought it. However, this preference will be reflected in the V_0 variable, not the α variable.

²³⁹ This will not apply to copyright products which consist largely of after sales support, like online-only games or high-capacity database software. However, these products only represent a small minority in the Australian consumer markets.

²⁴⁰ Consider PlayStation games, which cost roughly \$60 each and consist of only a DVD disc, a small black, plastic case and a single sheet of graphics for a cover. As explained above, the digital nature of the disc content means that the copied disc and the original disc would be functionally identical, for a user with a mod-chipped PlayStation. So the one-third, or \$20, loss in value, would have to be attributed to the black box, the cover and the graphics on the disc. This seems very extreme, when considering how many users, rationally, would pay an extra \$20 or 33 per cent for some pretty packaging.

This low α is used, however, to err on the side of caution. If the α variable is lower, then the benefits of circumvention will also be smaller, and the effect of anti-circumvention laws will appear proportionately larger. So, to demonstrate the ineffectiveness of anti-circumvention laws in complementary circumstances, this low α figure is applied.

[3.4.2] Price of the Copy (P_c)

For mod-chip and DVD Shrink users, the price of the copy will be the cost of a blank DVD, which is \$0.50.²⁴¹ These examples assume that the user already has a DVD burner at home, so the cost of such is already sunk and is irrelevant to the U_{CIRC} calculation.²⁴²

Where a user downloads the copy to a hard drive, like in example 3, the cost of the data transfer will be included in the copy price, but the hard drive space consumed is a sunk cost, and is ignored. While the internet cost is also sunk, variable charges for excess downloads, or internet speed throttling, make it necessary to consider some data transfer costs to be unique to the

²⁴¹ A spindle of 50 blank DVDs costs \$17.50. This equates to \$0.35 per disc, however, to account for inter-region price fluctuations and non-bulk purchases, the extra 40 per cent is added to give \$0.50. See, Digit Technology Corp, 'Display Products' <<http://www.blankdvdsupermarket.com.au/products.php?cat=15&pg=2>> (13 Oct 2007).

²⁴² This assumption is reasonable as DVD burners only cost about \$50 and are now a standard element of any PC. See, Shopbot.com.au, 'Cheap DVD Burners - Price Comparison - Buy at cheap prices' <<http://www.shopbot.com.au/c-137-1-0-1.html>> (13 Oct 2007).

illegal copying choice. The user in the DesignPro example is assumed to have an Australian ADSL2+ broadband connection with iiNet, which costs \$60 per month and allows 10 gigabyte of download in that time.²⁴³ Therefore, the cost per megabyte is \$0.00586, and since the DesignPro download is 150 megabytes, the data transfer cost comes to roughly \$0.88.

In example 4, the user has to purchase a pirated version of CADman for \$40, instead of copying it personally, so P_c will be equal to this amount.

[3.4.3] Cost of Finding a Copy Partner ($C_{PARTNER}$)

For a PlayStation 2 game or a DVD movie, the maximum cost of finding a partner is the cost of renting an original;²⁴⁴ which will include the price charged by the local rental store, and the travel costs. The travel costs are \$2.38 return, as explained above. The rental price for a DVD movie is \$7.50, while the rental price for a PlayStation 2 game is only \$4.00.²⁴⁵ This cost would, however, be almost zero if the user borrowed a disc from a friend instead of from a rental store.

²⁴³ iiNet, 'Broadband Plans' <<http://www.iinet.com.au/products/broadband/plans.html>> (31 Aug 2007).

²⁴⁴ Assuming that the user is looking for mainstream material, that is not very rare.

²⁴⁵ These prices were taken from the Sydney operations of the Blockbuster Australia multimedia rental chain, and may fluctuate for different regions and rental stores. These figures were chosen as a large chain must have reasonably competitive rates, to reflect the market equilibrium supply price, and will have a high market share, thus affecting more device users.

For the third example, the user need not physically acquire an original of the program he or she wishes to use, as the provider gives a URL address, from which a copy of the program may be downloaded. Therefore, this user has no significant partnering cost.

The user in example 4 also has a partnering cost of zero, as the provider's neighbouring stall at the market sells pirated versions; and this is demonstrated to the user when buying the Crackman device.

[3.4.4] *Psychological Costs (C_{ETHIC} & $C_{CIRCETHIC}$)*

As explained earlier, modern society has developed an acceptance for copyright breaches, which means that the ethical costs of copying content or circumventing a TPM, will be low.²⁴⁶ Therefore, both C_{ETHIC} and $C_{CIRCETHIC}$ have been given the small and relatively insignificant value of \$0.05 each.

[3.4.5] *Device Acquisition Cost (C_{DEVICE})*

As the DVD Shrink software is free, the C_{DEVICE} variable for the first example is really the cost of the user's time in locating and downloading the device.

²⁴⁶ See articles cited in note 120, above.

This cost should be meagre, as search engine queries for the software yield immediate results.²⁴⁷ So the time taken to acquire a CSS circumvention device should not exceed 2 hours;²⁴⁸ which equates to \$61.46 based on the first example's user salary of \$59,000.²⁴⁹ This amount is summed with the cost of downloading the software from the website or Bit Torrent network. This download cost is calculated using the same internet cost data as in example 3;²⁵⁰ so the cost of downloading the 1.04 megabyte DVD Shrink software is \$0.0061.²⁵¹ Therefore, the total cost of acquiring the device is \$61.4661, which is divided amongst the 10 DVDs that the user copies, to give a per circumvention cost of \$6.15.

²⁴⁷ If the user knows which program to acquire, the search term "DVD Shrink" in Google renders a DVD shrink download site as the first link, as does the term "DVD backup free software". It is not integral that the actual DVD Shrink software is found, only that some form of free CSS cracking circumvention device is found. Such a device can be easily acquired from a Google search using terms like 'DVD copy free' or 'DVD backup free'. DVD Shrink is also readily available on many peer-to-peer and Bit Torrent networks, if the user is technologically literate enough to use them. See, Google, 'DVD Copy Free – Google Search'

<<http://www.google.com.au/search?num=100&hl=en&safe=off&q=dvd+copy+free&meta=>> (1 Sep 2007); Google, 'DVD Backup Free – Google Search'

<<http://www.google.com.au/search?num=100&hl=en&safe=off&q=dvd+backup+free&meta=>> (1 Sep 2007); Mininova, 'Search Results for DVD Shrink – Mininova'

<<http://www.mininova.org/search/dvd+shrink/seeds>> (1 Sep 2007); IsoHunt Inc, 'DVD Shrink – isoHunt – World's Largest BitTorrent and P2P Search Engine'

<<http://www.isohunt.com/torrents/?ihq=DVD+shrink>> (1 Sep 2007).

²⁴⁸ If DVD Shrink is not specifically found after a 2 hour search, a dozen other CSS circumvention devices could be. So regardless of the device's name, the user will have a device that can circumvent the CSS TPM.

²⁴⁹ This figure is derived from the average Australian's total earnings, which, according to the Australian Bureau of Statistics, come to \$1,134.30 per week, or \$58,983.60 per year. See, Australian Bureau of Statistics, '6302.0 – Average Weekly Earnings, Australia, May 2007'

<<http://www.abs.gov.au/AUSSTATS/abs@.nsf/ProductsbyCatalogue/BA84BBB55B643021CA2568A90013934E?OpenDocument>> (22 Sep 2007).

²⁵⁰ See section 3.4.2 at 111 above.

²⁵¹ The per megabyte download cost is \$0.00586. This amount multiplied by 1.04 megabytes gives a download cost of \$0.0061.

The device acquisition cost for a PlayStation user is the price of the mod-chip, \$110,²⁵² plus the travel price of \$2.38.²⁵³ As the device allows multiple infringements, this amount is divided among the total 18 games that are copied, to give a per-game C_{DEVICE} of \$6.24.

The total number of 18 games copied is based on the assumption that the user will only want 3 new games each year, and that the console has a useful life of 6 years before it is made obsolete.²⁵⁴ To copy only 18 games over the life of a console is an overly conservative estimate, considering that the user's marginal cost of copying a new game can be as low as \$0.50.²⁵⁵ If a user buys more games, they will appreciate greater benefits from being able to copy, and will thus have a higher utility of circumvention. So by keeping this figure at the artificially low level of 3 games per year, the assertions of the model are made applicable to all users, even those with low benefits of circumvention.²⁵⁶

As there is no travel expense incurred by the ProBuster user in the third example, only the price of the device, \$20, is included in the C_{DEVICE} value.

²⁵² Mod-chip price taken from Consoletronics, 'PS2 Xbox Modchip Specialist in Sydney' <<http://www.consoletronics.com>> (2 Aug 2007).

²⁵³ See section 3.3.3 at page 107 above.

²⁵⁴ The Sony PlayStation 2 was released in 2000, but new games are still being released for it in 2007 and 2008. So a six year life seems reasonable, considering that the PlayStation 2 will not be made obsolete by the PlayStation 3 for at least two more years.

²⁵⁵ Assuming that the user borrows a game from a friend for free, the marginal cost will be limited to the cost of a blank DVD.

²⁵⁶ This also makes the effect of anti-circumvention laws appear proportionally greater.

The fourth example, however, does require travel. So the C_{DEVICE} value for the Crackman user is composed of the \$2.38 travel expense and the \$60 device price; totaling \$62.38.

[3.4.6] *Virus Risk Cost (C_{VIRUS} & $C_{\text{CIRCIVIRUS}}$)*

When copying a DVD movie, there is generally no risk of contracting a digital virus, because the data is taken from an original DVD, which is produced by the copyright owner and not an underground hacking group.²⁵⁷ Therefore, the C_{VIRUS} variable is set to zero, for users in the first example. The DVD Shrink circumvention device, as an underground hacking tool, may contain a virus. But because DVD Shrink is so widespread and abundant, there are highly reputable sources that can be turned to for acquisition.²⁵⁸ So the first examples' $C_{\text{CIRCIVIRUS}}$ is given the low value of \$0.01.

PlayStation games cannot have viruses, if copied from an original, so they cannot damage the console or the data in it. The mod-chip also cannot carry a virus, though it can cause systemic failure in the console. If the mod-chip

²⁵⁷ Also, the content of a DVD movie disc is simply raw data that is processed, not an application that is run, so there is a low probability that the content could even be infected.

²⁵⁸ A Google search for the terms 'DVD shrink free download' renders the top three results Soft32.com, Download3000.com and Softpedia.com, which are all trust-worthy download sources.

malfunctions, the user's PlayStation 2 console may not be able to read games and will become useless.²⁵⁹ To fix the problem the unit will need repairing. The cost of repair could be anywhere from \$20, for a quick repair, to \$110, for a complete chip replacement.²⁶⁰ To portray the effects of anti-circumvention laws favourably, in line with the criminal law cost estimations, 75 per cent of the maximum shall be taken as the cost of repair.²⁶¹ So, 75 per cent of \$110 is \$82.50, and the chances of having a problem with a mod-chip are at most 1 in 20, or 5 per cent, so the expected cost per device is, at maximum, \$4.13.²⁶²

Much like DVD movies and PlayStation 2 games, DesignPro is acquired from the copyright owner in the form of a trial version. Thus there is no risk of contracting a digital virus. There is a small chance that the circumvention device could cause an infection, however to remedy this, the user only has to run an anti-virus software check once. So, as the remedy is so simple, and

²⁵⁹ There are some recurring problems with mod-chips, like laser burn-outs, display drop-outs and disc reading difficulties. See, 'ABC Online Forum' <<http://www2b.abc.net.au/science/techtalk/newposts/453/topic453960.shtm>> (31 Aug 2007); 'The Screen is Black and White After Modding' <http://forums.afterdawn.com/thread_view.cfm/553923> (31 Aug 2007).

²⁶⁰ 'Australia's Leading Repairs Specialist XBOX360 Wii (BALMAIN)' <<http://cracker.com.au/classifieds/sydney/for-sale/videogames/304843097.asp>> (31 Aug 2007); Consoletronics, 'PS2 Xbox Modchip Specialist in Sydney' <<http://www.consoletronics.com>> (2 Aug 2007).

²⁶¹ This cost is given a high value because this will reduce the attractiveness of circumvention. This in turn will make anti-circumvention laws appear more able to close the circumvention device market and more able to dissuade circumventers.

²⁶² See note 261 above.

anti-virus software is a necessity for any computer that is connected to the internet,²⁶³ the virus risk cost ($C_{\text{CIRC}}^{\text{VIRUS}}$) is set at the very small figure of \$0.01.

Like the other examples, the virus risk for users in the fourth example is low. The Crackman dongle simply contains algorithm data that is checked by CADman as it functions. Because nothing on the dongle runs, there is a very low chance that it would, or indeed could, infect a PC. Also, as the pirated software is sold in the same place each week, and the seller can be held accountable, it is in the seller's best interest to ensure an infection-free product to avoid conflict.²⁶⁴ With this considered, the $C_{\text{CIRC}}^{\text{VIRUS}}$ and C_{VIRUS} variables are set to \$0.01.

[3.4.7] *Probability of Being Punished (p)*

As there have been no Australian anti-circumvention cases involving users, there is no empirical evidence that may indicate the likely p value for the average user.²⁶⁵ Therefore, some calculations and logical references must be

²⁶³ In fact, Windows XP has inbuilt virus protection software that scans for, and deals with the most heinous computer viruses. See, Microsoft, 'Malicious Software Removal Tool' <<http://www.microsoft.com/security/malwareremove/default.aspx>> (20 Oct 2007).

²⁶⁴ An angry customer could report intimate details of the seller's operations to the Australian Federal Police, which could increase the provider's probability of being punished (p).

²⁶⁵ As explained in section 3.2.8 at page 99, actual probability must replace perceived probability to avoid an under-representation of the effect of anti-circumvention laws. Since there have been no prosecutions against individual circumventers, the perceived

made, to develop a p value that is comparable, and can be used in the place of an actual anti-circumvention p .

To favourably estimate the enforcement of Australian anti-circumvention laws, p will be predicted using empirical information on traditional copyright enforcement in the US music industry. This industry has taken more legal actions against consumer-level digital copiers, than any other. So by using this data, the absolute maximum copyright p may be calculated.

This p will not necessarily represent the enforcement of Australian anti-circumvention laws. But, by using this atypically high p , this analysis can illustrate the ineffectiveness of the user laws, in even the most complimentary circumstances.

The International Federation of the Phonographic Industry (IFPI) calculates that 20 billion music files are illegally downloaded world-wide each year.²⁶⁶ According to the most recent research of Felix Oberholzer-Gee and Koleman Strumpf, the USA is responsible for 35.7 per cent, or 7.14 billion, of these

probability should be zero. This would nullify any effect of anti-circumvention law punishments. But to properly illustrate the ineffectiveness of anti-circumvention laws, it must be demonstrated that they fail, even in favourable circumstances.

²⁶⁶ International Federation of the Phonographic Industry (2006), above, note 123, at 4; International Federation of the Phonographic Industry, *IFPI 2007 Recording Industry in Numbers* (UK: IFPI, 2007), at 18.

illegal downloads.²⁶⁷ The Recording Industry Association of America (RIAA) has sued 26,000 American music downloaders,²⁶⁸ since its enforcement campaign began in 2003.²⁶⁹

So the total US downloads, over the four year period from 2003 to today, would be 28.56 billion music files.²⁷⁰ To determine the probability of being punished (p), the number of punishments must be divided by the number of contraventions. Dividing 26,000 lawsuits by the 28.56 billion files downloaded gives a per infringement p of 0.000091 per cent.

This 0.000091 per cent probability is the absolute maximum digital copyright user-enforcement rate in the world, and will not be repeated in Australia. However, it illustrates that even if copyright owners were to enforce Australian anti-circumvention law incredibly vigilantly, the p_{CIRC} value would still be tiny.²⁷¹

²⁶⁷ Oberholzer & Strumpf, above, note 229, at 11.

²⁶⁸ Moses A, 'Music Industry Has Aussie Pirates in the Crosshairs', *Sydney Morning Herald*, 8 October 2007: <<http://www.smh.com.au/news/web/aussie-downloaders-in-the-crosshairs/2007/10/08/1191695804646.html>> (10 Oct 2007).

²⁶⁹ Electronic Frontier Foundation, 'How To Not Get Sued for File Sharing' <<http://www.eff.org/IP/P2P/howto-notgetsued.php>> (1 Aug 2007).

²⁷⁰ As, 7.14 billion files per year multiplied by 4 years equals 28.56 billion music files.

²⁷¹ This actual probability may be perceived to be larger, due to the randomness of the RIAA lawsuits. But even if the figure was multiplied ten times, to give a p of 0.00091 per cent, the user law cost variable would remain minute. This insignificant law cost is supported by evidence that file-sharers and downloaders still do not care whether files are copyright protected, as the probability of being punished under copyright law is so small. See, Madden M & Lenhart A, 'Pew Internet Project Data Memo' July 2003 <http://www.pewinternet.org/pdfs/PIP_Copyright_Memo.pdf> at 1, 5-6 (7 Aug 2007).

For simplicity's sake, the 0.000091 per cent figure will be taken as the per contravention probability for both the acts of copying (p_{COPY}) and circumvention (p_{CIRC}).²⁷² The p_{CIRC} variable is probably much smaller than the p_{COPY} variable, in reality, because of the minimal awardable damages; but this over-sized figure is used to further accentuate the effect of anti-circumvention laws.

[3.4.8] *Punishment Cost (C_{AC-LAW} & C_{LAW})*

The punishment cost for the user model is limited to civil remedies, as the users being assessed in the models are private, non-commercial circumventers. The criminal remedies for access control TPM circumvention, under s 132APC, are only applicable if the user circumvents 'with the intention of obtaining a commercial advantage or profit'. As stipulated by s 132AA, profit does not include any benefit gained from private or domestic use of copyright material, so the users considered here will not face criminal punishments.

The copyright owner's civil remedies, when suing a user, are calculated with reference to Australian copyright case law, much like the providers' remedies

²⁷² This 0.000091 per cent p is probably many times the actual anti-circumvention p . However, it is applied in the models to demonstrate the complete ineffectiveness of s 116AN, even in extremely favourable circumstances.

are.²⁷³ The added complication is that, the user may be sued for copyright infringement, together with circumvention. If this occurs, the copyright owner will usually recoup their loss through the infringement action and no further compensatory damages will be justified for circumvention.²⁷⁴

So where infringement occurs together with circumvention, the models assume that the compensation is assigned to C_{LAW} , not C_{AC-LAW} ; as these damages could have been recovered before the introduction of anti-circumvention laws, anyway. If no infringement occurs, however, the compensatory damages will be part of C_{AC-LAW} .

[3.4.8.1] *COPYRIGHT INFRINGEMENT DAMAGES (C_{LAW})*

Infringement and Circumvention?

The ProBuster user will not necessarily infringe copyright by legally downloading the trial, then continuing to use it past the expiry period. It is arguable, in this case, that no illegal reproduction occurs,²⁷⁵ only unauthorised

²⁷³ See section 3.2.7 at page 89 above.

²⁷⁴ There cannot be double-recovery of the same loss, as this would extend the civil remedy beyond compensation.

²⁷⁵ While *Stevens v Kabushiki Kaisha Sony Computer Entertainment* (2005) 221 ALR 448 (HCA) established the precedent that reproductions in RAM are not reproductions in material form, it could be argued that the recent changes to Australian copyright law have nullified this precedent. The s 10 definition of 'material form' no longer requires the copy to be retrievable. So a RAM reproduction could be considered a reproduction in material

access; which does not constitute an infringement of copyright.²⁷⁶ So the example 4 user would not be sued for infringement, and would thus have a C_{LAW} variable of zero.

On the other hand, it is very likely that copyright owners will sue the DVD Shrink, mod-chip and Crackman users for both infringement and circumvention contraventions. In these examples, both contraventions occur and the evidence needed to prove one, will likely prove the other.²⁷⁷ For instance, if a Crackman user is proven to have circumvented the TPM on a pirated copy of CADman, it should also be evident that the CADman software was installed on the user's PC. This installation is an unauthorised reproduction of the work and thus infringes copyright. So, evidence of the act of infringement is either already acquired to prove circumvention, or it may easily be collected.

form. This means that each time a user runs any digital copyright product, without the copyright owners' permission, that user may be reproducing the works in material form and may thus be liable for infringement. This point is uncertain, as such massive scope will arguably be narrowed by the courts. So in order to emphasise the potential penalties for circumvention (C_{AC-LAW}), it is assumed that there is no infringement and that compensation for lost DesignPro sales may be awarded in this ProBuster user's anti-circumvention law remedy. See, Weatherall (2006), above, note 155.

²⁷⁶ According to Part III of the Act.

²⁷⁷ DVD Shrink and mod-chip users will almost always infringe copyright after circumventing. DVD Shrink is primarily used to format shift and copy DVD movies. Both of these acts constitute an unauthorised reproduction of the work, and therefore an infringement of copyright. Mod-chips allow the use of pirated games, so a user will typically reproduce the games, and thus infringe copyright.

Note, however, that while copyright owners could take action for both breaches together, in order to maximise the return from their lawsuits, they could not recover doubly; at least to the extent that the damages perform a compensatory function.

Compensatory Damages under s 115(2)

Each of these copyright infringements would result in compensatory damages equal to the profits lost by the copyright owner.²⁷⁸ Referring back to the provider damages section, 80 per cent of the original price will be the maximum profit that a copyright owner would lose; so this amount will constitute the compensatory element.²⁷⁹

Punitive Damages under s 115(4)

The users considered here only infringe in a non-commercial, private and domestic setting; unlike large-scale commercial pirates. As the user infringements sit at the low end of the spectrum of heinousness, the Australian case law indicates that their s 115(4) additional damages should not exceed 50 per cent of the compensatory damages.²⁸⁰

²⁷⁸ This method of s 115(2) damages quantification is taken from *Norm Engineering v Digga Australia* (2007) 72 IPR 332, paras 291-294 (FCA).

²⁷⁹ See section 3.2.7 at 89 above.

²⁸⁰ See note 204 above.

Liability

Each user's legal liability, per circumvention,²⁸¹ is limited to the profits lost from the sale of one original product, as each circumvention will, at most, result in one lost sale.²⁸²

[3.4.8.2] *ANTI-CIRCUMVENTION DAMAGES (C_{AC-LAW})*

Compensatory Damages under s 116AQ(1)

As the copyright owners from examples 1, 2 and 4 are already fully compensated for their lost profits, only additional damages could be awarded for a breach of s 116AN.

However, the copyright owner in the DesignPro example would not be compensated by an infringement action, and thus may be awarded compensatory damages as part of the circumvention remedy. In the worst case scenario, the copyright owner would prove that the circumvention

²⁸¹ Note that the user model, developed in this paper, calculates the utility of circumventing once. So, it is necessary to consider the potential copyright infringement punishment that will accompany a single circumvention.

²⁸² The DVD Shrink user must circumvent CSS each time a DVD movie is copied; so the ratio of circumvention to reproduction will be one-to-one. The CADman software, on the other hand, is only reproduced once, upon installation, but its TPMs are circumvented by the Crackman device each time the software is run. Similarly, the mod-chip user circumvents the PlayStation 2 TPM each time the console is turned on and the mod-chip is activated; however, infringement will only occur when the user copies a new game. In the Crackman and mod-chip examples there will be, arguably, less than one original sale lost per circumvention. However, to emphasize the effect of anti-circumvention laws, this high liability is accepted.

caused a lost sale, and the ProBuster user would be liable to compensate for the corresponding forgone profits. These profits would, as above, be equal to 80 per cent of the original product price.

Punitive Damages under s 116AQ(2)

To quantify the users' additional damages for circumvention, the above analysis into the likely provider damages will be drawn upon again.²⁸³

Users differ from providers, in that their circumvention contraventions are far less heinous,²⁸⁴ and users only circumvent for private or domestic use, without seeking commercial advantage or profit. So the user's s 116AQ(2) additional damages should not exceed those of the non-commercial provider. Therefore, the user's additional damages, for a breach of s 116AN, are estimated at 50 per cent of the compensatory damages.²⁸⁵

This figure is large, but in the interest of reinforcing the assertion that anti-circumvention laws are ineffective, this conservatively large cost of punishment figure is used.

²⁸³ See section 3.2.7 at page 89 above.

²⁸⁴ The maximum criminal penalty for circumventing is only 60 penalty units, which is less than 10 per cent of the maximum criminal penalty for providing. Therefore, it is clear that the law considers it a far less heinous offence.

²⁸⁵ See above, note 204. As the compensatory damages are 80 per cent of the original price (P_o), the additional damages will equal 40 per cent of P_o .

Liability

As explained in the section above, the users' liabilities will be limited to the profits lost from one forgone sale.²⁸⁶

[3.4.8.3] THE FIGURES

The table below summarizes the C_{LAW} , C_{AC-LAW} and P_O figures for each example:

USER	P_O	C_{LAW}	C_{AC-LAW}
1. DVD Movies	30	36	12
2. PS2 Games	60	72	24
3. DesignPro	90	0	108
4. CADman	350	420	140

²⁸⁶ The ProBuster user will circumvent once, in order to use one copy of the DesignPro software, indefinitely. Hence, the DesignPro copyright owner will lose less than one original sale per circumvention. However, to portray the effects of anti-circumvention laws favourably, the models assume that this user will be held responsible for one lost sale per circumvention.

4 RESULTS

This chapter considers the three ways that anti-circumvention law could stop consumer-level, digital piracy. Firstly, user laws could stop circumvention outright; by increasing the user law cost variable and subsequently reducing users' utilities below zero or U_{BUY} .

Alternatively, provider laws may stop providers from supplying circumventive capability, by increasing their law cost variable and thus pushing their U_{DEAL} below zero. Once all providers are stopped, and the supply of circumventive capability is extinguished, most users will not be able to circumvent, and thus will not be able to engage in piracy.

Or, finally, if providers cannot be stopped altogether, then provider laws could still drive increased device prices or reduced supply. This could increase the users' costs of device acquisition so far, that they would lose their superior U_{CIRC} , and would consequently stop circumventing.

The following results section considers users and non-commercial providers as groups of people who have varying benefits of contravention (V_O or B_{PYSCH}). This is done because these benefits will vary greatly among

individuals and are not dictated by market forces. Therefore, to accurately represent reality, the different market-independent values must be considered.

Commercial providers, on the other hand, are depicted as single individuals, with standardised costs and gains, as their benefits (B_{FINC}) will only vary as the market demands it.

[4.1] Do the User Laws Stop Circumventers?

The numerical analyses show that, because the user's maximum probability of punishment is only 0.000091 per cent, the legal punishment ($C_{\text{AC-LAW}}$) will never act as a significant deterrent. Regardless of how severe anti-circumvention punishments are, the insignificant magnitude of the p variable renders the law cost variable almost entirely ineffective at altering the user's utility of circumvention. Therefore, the user laws will not deter a significant number of circumventers.

Results Table 1

USER	Probability of being Punished (p)	Punishment Cost (C_{AC-LAW})	Reduction in Utility from user A-C Laws (p × C_{AC-LAW})
1. DVD Movies	0.000091%	12	\$0.000011
2. PS2 Games	0.000091%	24	\$0.000022
3. DesignPro	0.000091%	108	\$0.000098
4. CADman	0.000091%	140	\$0.000127

Relative to the variables described in the section above, one can appreciate the triviality of the law cost variable in the user model.²⁸⁷

The utility reduction figures given above are constant for all users in the market. So the user law cost variable will only drive U_{CIRC} below zero or U_{BUY} , for users who had a very marginal utility to begin with. For instance, a mod-chip user, with a U_{BUY} of zero, would need a U_{CIRC} of \$0.000021 to be economically dissuaded from copying, by the user laws.²⁸⁸ At this level, it is safe to say that the user is so close to the border of circumventing and not circumventing, that any minor change in any of the other variables would tip the scales anyway.

²⁸⁷ See Values Table 2 and Values Table 3 at 105 above.

²⁸⁸ Users with higher U_{BUY} values would only be deterred if their utility of circumvention was \$0.000021 higher than their U_{BUY} . Regardless of the U_{BUY} value, the argument holds true that any dissuaded users would be extremely close to the border of circumventing and not circumventing.

This can be appreciated by reviewing the tables on page 105, and the magnitude of the variables therein. Indeed, this tiny utility reduction could equally result from a \$0.000022 increase in the cost of a blank DVD (P_c), the travel cost or the rental price (C_{PARTNER}). So, if anti-circumvention laws can only reduce user utility (U_{CIRC}) by a trifling 0.0044 per cent of the \$0.50 blank DVD cost, it is plain to see that the 0 to \$0.000022 range will deter, at best, an insubstantial number of users.²⁸⁹

It is evident that while user laws do have some effect, that effect changes utility so slightly that the number of users deterred is insignificant. Therefore, the Australian civil prohibition on circumventing access control TPMs, under s 116AN, is not effective at protecting or enhancing copyright owner interests.

[4.2] Do the Provider Laws Stop Providers?

Provider laws introduce the anti-circumvention law cost variable, which increases providers' costs and consequently reduces their utilities of providing. However, this cost increase is of insufficient magnitude to stop a significant number of commercial or non-commercial providers.

²⁸⁹ Moreover, because of the tiny size of this range, few circumventers will fall within its bounds.

Results Table 2

PROVIDER	Law Cost Variable			Total of all other costs in the U_{CIRC} equation (C_{DEAL})	Percentage of Other Cost
	<i>Criminal</i>	<i>Civil</i>	<i>Total Reduction of Utility</i>		
1. DVD Shrink	\$0.00000	\$0.00360	\$0.00360	\$0.02497	14%
2. Mod-chip	\$30.79	\$0.96	\$31.75	\$33.66	94%
3. ProBuster	\$2.70	\$0.01	\$2.71	\$0.45	600%
4. Crackman	\$23.29	\$0.70	\$23.99	\$40.63	59%

[4.2.1] Non-Commercial Providers

As explained in section 2.3.3.1, cost increases can deter non-commercial providers, who have low psychological benefits (B_{PSYCH}). Unfortunately, anti-circumvention laws cannot increase costs sufficiently, to stop a significant number of non-commercial providers.

Non-commercial providers typically supply users with free, software-based circumvention devices, which can easily be transferred over the internet anonymously, by many individuals.²⁹⁰ This means their chances of being caught are very low. This reduced probability of punishment (p_{CIVIL}) diminishes the effect of the law cost variable ($p_{CIVIL} \times C_{AC-CIVIL}$) to such an

²⁹⁰ See section 3.2.8.2 at page 103 above.

extent, that even extreme punishment costs ($C_{AC-CIVIL}$) would only cause a minimal reduction in non-commercial provider utility (U_{DEAL}).²⁹¹

Notice also that the non-commercial provider is probably not faced with criminal sanctions,²⁹² as ss 132APD and 132APE only apply to individuals who provide 'with the intention of obtaining commercial advantage or profit'; which the non-commercial provider, by definition, does not. So the provider's law cost is also reduced by eliminating the criminal element altogether.

These two attributes explain why the DVD Shrink provider, in example 1, has such a low utility reduction, relative to the other providers. This minimal utility reduction means that only providers with utilities below \$0.0036 would be effectively deterred from providing, by anti-circumvention laws.

The time cost of providing (C_{TIME}), being the only other significant cost, amounts to \$0.02497; which is 7 times the size of the anti-circumvention law

²⁹¹ For anti-circumvention laws to even match the \$0.02497 other costs of the DVD Shrink provider, the copyright owner would have to be awarded compensatory and punitive damages for the loss of 70 original DVD sales; or \$2,520. This is far beyond the realm of reality, considering the difficulties in proving causation that were outlined in section 3.2.7.1, on page 89 above.

²⁹² The criminal section 132AC may be applied by a copyright owner, to sue a provider for engaging in conduct that results in multiple infringements, on a commercial scale, that substantially detriment the copyright owner. This has a penalty equal to those of the commercial provider; but this would be a very difficult case to prove. While there is a clear connection between the sale of an infringing copy and the potential loss of a sale, the provider's role is far more remote from the damage. A provider may or may not allow another individual to infringe once, or many times, but will not infringe personally or directly cause lost sales. This added distance between the damage and the provider, and the lack of provider control over the infringer's activities, will make a s 132AC action very difficult to prove.

cost. This would indicate that, relative to the other costs in the non-commercial provider's equation, the cost imposed by anti-circumvention laws is rather meagre.

Obviously, this comparison will hinge largely on the value the provider puts on his or her time; but the C_{TIME} variable is given a minimal value in this example. First, the DVD Shrink provider is taken to be a low income earner, making only \$35,000 per year. Second, while it only takes this technology-savvy provider 30 minutes to upload DVD Shrink on a Bit Torrent network, it would take much longer if the given provider was inexperienced at providing, or if the software-device was made accessible on a website.

Indeed, even a 5 minute increase in the time taken to provide would cause a per device time cost (C_{TIME}) increase of \$0.00416. This is 15 per cent greater than the cost increase caused by anti-circumvention law. In fact, the anti-circumvention law effect is equivalent to only 4.3 extra minutes taken to provide. This extra time could easily result from the most trivial of outside factors, like a tracker site that uploads more slowly, or a need to set a handful of preferences for the torrent file.

The triviality of this level of cost would indicate that the law cost imposed by anti-circumvention laws is not of sufficient magnitude to dissuade a substantial number of DVD Shrink providers. Perhaps a very small number of

hobbyist providers will be dissuaded, however the vast majority will continue.²⁹³

So, even though the quantum of psychological benefits (B_{PSYCH}) cannot be precisely determined, it has been demonstrated that anti-circumvention laws do not increase costs significantly for non-commercial providers.²⁹⁴ This indicates that anti-circumvention laws cause only a minor reduction in utility, and thus deter an insubstantial number of non-commercial providers.

[4.2.2] *Commercial Providers*

As section 2.3.3.1 explained, commercial providers are able to increase their benefits (B_{FINC}) to allow them to retain a positive U_{DEAL} , even when faced with serious cost increases. This means that the costs imposed by anti-circumvention laws ($p \times C_{\text{AC-LAW}}$) will not deter commercial providers, as long as they can increase their prices (B_{FINC}) to combat them.

²⁹³ This may have a tiny effect, if any, on casual providers, but the fanatical underground hacking groups will not be deterred in the least. These groups appreciate massive psychological benefits (B_{PSYCH}) from their providing activities, because of inter and intra-group accolades for creating and disseminating circumvention devices. These providers, like fanatical terrorists, will never be stopped, as their B_{PSYCH} stretches far beyond the deterrent capabilities of any modern, democratic laws.

²⁹⁴ It has also been proven that this statement holds true, even when anti-circumvention laws are depicted with high punishments and extremely high enforcement rates.

[4.2.2.1] AT WHAT STAGE WILL COMMERCIAL PROVIDERS BECOME VULNERABLE TO COST INCREASES?

At some stage, device and service prices will become higher than the market can bear, and providers will be unable to increase their prices any further. This means that they will not be able to improve their benefits (B_{FINC}), and any further cost increases would cause their U_{DEAL} values to fall below zero. At this point, commercial providers would be effectively deterred from providing.

The point at which the market cannot bear further price increases can be explained by two values. Firstly, the $C_{\text{DEVICE}}^{\text{MAX}}$ variable represents the maximum price that users can pay for a circumvention device or service, while retaining a U_{CIRC} greater than both U_{BUY} and zero. Secondly, the $B_{\text{FINC}}^{\text{MIN}}$ variable is the minimum price that providers can charge for a circumvention device or service, while retaining a U_{DEAL} greater than zero.

Commercial providers will only be deterred from providing when the minimum price that providers can charge ($B_{\text{FINC}}^{\text{MIN}}$) exceeds the maximum price that users are willing to pay ($C_{\text{DEVICE}}^{\text{MAX}}$).²⁹⁵ At this stage the market for

²⁹⁵ Recall that B_{FINC} is a positive element in the U_{DEAL} equation, while C_{DEVICE} is a negative element in the U_{CIRC} equation.

circumvention devices and services will be closed, as there will be no demand at the prices where there is supply.

The point of market closure will be identified, for each example, in section 4.4 below.

[4.3] How Provider Laws Affect the Supply of Circumvention Devices and Services

[4.3.1] *Commercial Providers*

With reference to Results Table 2 above, it seems apparent that when the model factors in the effects of the section 116AO, 116AP, 132APD and 132APE provider anti-circumvention laws, a significant increase in provider costs is observed.²⁹⁶ Thus, to keep their utility of providing positive, the commercial providers must increase their prices (B_{FINC}).

Even though some providers will increase their prices above the minimum ($B_{\text{FINC}}^{\text{MIN}}$), in order to appreciate super-normal profits, such returns are not necessary to keep them providing; so such figures are not a reliable basis for

²⁹⁶ For a discussion of the quantum of sales reclaimed, as a result of this utility reduction, see section 4.5 at page 152 below.

evaluating the number of providers deterred.²⁹⁷ The variable that is decisive, on a market scale, is the minimum price that providers must charge, for providing to be worth their time; or $B_{\text{FINC}}^{\text{MIN}}$.

Therefore, by assessing the change in minimum circumvention device sales price ($B_{\text{FINC}}^{\text{MIN}}$), conclusions can be drawn regarding the effectiveness of provider laws. This minimum device price must increase as provider costs rise, because providers will have to charge more, to retain a positive utility (U_{DEAL}).²⁹⁸

Results Table 3

PROVIDER	Minimum Device Sales Price ($B_{\text{FINC}}^{\text{MIN}}$)			
	<i>Without Laws</i>	<i>With Laws</i>	<i>Change \$</i>	<i>Change %</i>
2. Mod-chip	\$33.65	\$64.49	\$30.84	92%
3. ProBuster	\$0.44	\$3.15	\$2.71	614%
4. Crackman	\$40.62	\$64.60	\$23.99	59%

As can be seen in the given table, anti-circumvention laws drive minimum circumvention device prices up significantly for commercial providers. Mod-chip prices are almost doubled, Crackman dongle prices are increased by nearly two thirds and the ProBuster software-device prices are increased by a massive 614 per cent.

²⁹⁷ Furthermore, a competitive, efficient market will drive all providers to set their prices at the minimum level possible.

²⁹⁸ So, the more effective the laws are, the more the minimum price ($B_{\text{FINC}}^{\text{MIN}}$) will be increased.

The minimum price of the ProBuster device, from example 3, is increased so much more than the others because of the nature of the model's assumptions about the criminal penalties to be applied. The potential civil remedy is related to the damage caused to the copyright owner, and will thus correlate with the price of the original and the financial benefits of providing. These elements are rather small for the ProBuster provider, who charges little and only causes one \$90 infringement. However, the criminal penalty is set by the statute and will vary with the degree of offence, rather than only the damage caused to the copyright owner. Of course, the damage caused to the copyright owner will also be considered, however it is not necessarily the only concern of the court. This means that for low cost, low margin products, like ProBuster devices, the criminal law cost will have a proportionately greater impact on utility.

[4.3.2] *Non-Commercial Providers*

A similar approach can be taken to test the effects of anti-circumvention laws on the supply of freely provided devices and services. Drawing on the results and analyses from section 4.2.1, it is clear that anti-circumvention laws do not deter a significant number of providers.

Because only an insignificant number of providers are stopped, the supply of DVD Shrink will continue largely unchanged. This unfaltering supply stems from two market attributes. Firstly, there are simply far too many DVD Shrink providers operating in the market, for a few deterred providers to make a difference. Secondly, non-commercial, online software-device providers have a massive capacity to provide. If necessary, each provider can supply more than 12,000 users per day.²⁹⁹ So it is not simply that another individual could take the place of the deterred providers, but also that so few providers are needed to keep the market flushed with devices.

This indicates that anti-circumvention laws will not make DVD Shrink, and similar free software-devices, noticeably scarcer.

²⁹⁹ This is assuming that devices are provided over a Bit Torrent network, as in the example. In this case, the capacity to provide would be limited only by the provider's internet speed. So this provider, who has an ADSL2+ connection, could easily upload at 150 kilobytes per second, providing more than 12,000 copies of DVD Shrink in 24 hours. A website could upload far faster than this, and would only be limited to the traffic cap of its hosting server.

[4.4] Why the Circumvention Device and Service Markets Cannot Be Closed

[4.4.1] *Circumvention Products and Services Provided Commercially*

As explained in section 4.2.2.1, to effectively stop commercial providers, anti-circumvention laws would have to close the market for circumvention devices and services, altogether.³⁰⁰ This may be achieved by increasing the minimum price that providers must charge ($B_{\text{FINC}}^{\text{MIN}}$), above the maximum price that users are willing to pay ($C_{\text{DEVICE}}^{\text{MAX}}$).³⁰¹

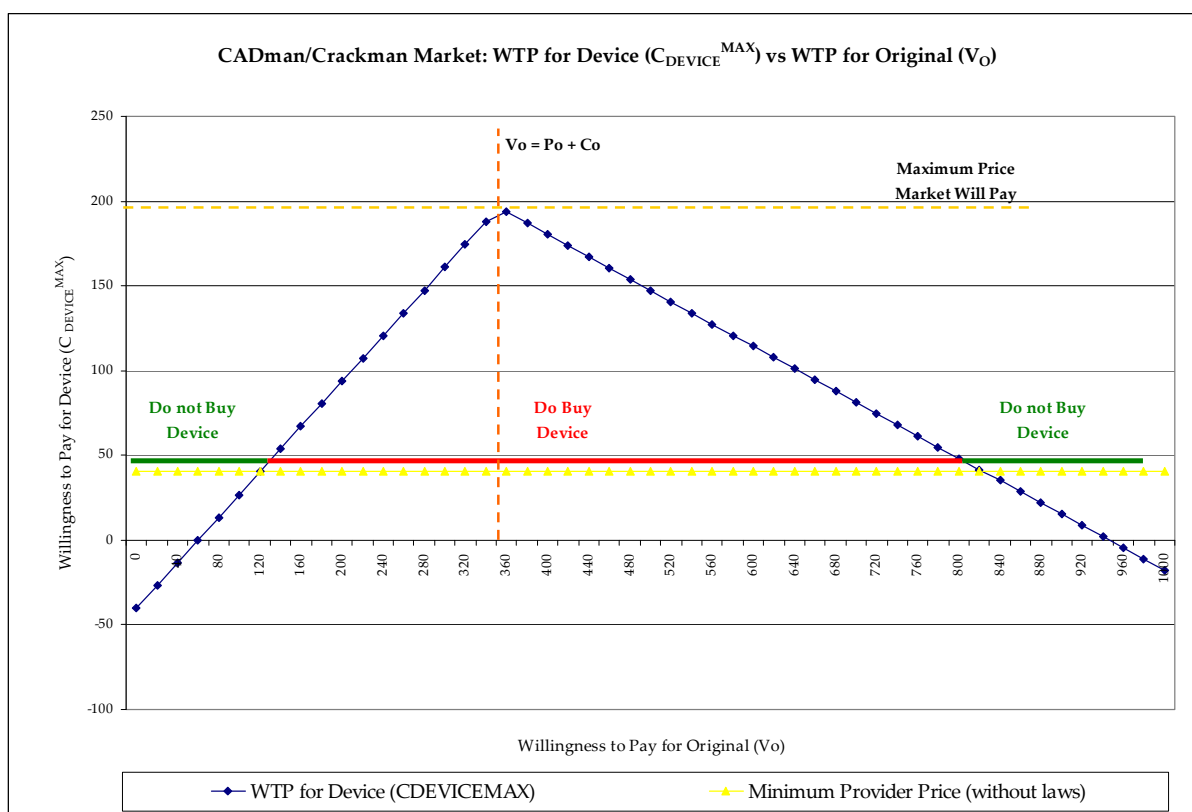
If the market is closed, then providers will be stopped. And if providers are stopped, then the flow of circumventive capability from the inner circle to the outer circle is blocked, and users will be unable to circumvent or unlawfully use the restricted material. So, if anti-circumvention laws closed the market for devices, they would meet their objectives of reducing circumvention and protecting the interests of copyright owners. They however, do not achieve this, and probably could not conceivably do so in any circumstance.

³⁰⁰ See section 4.2.2.1 at page 136 above.

³⁰¹ Ibid.

Graph 1 illustrates the market of device-buying users as a range of willingness to pay (V_o) values,³⁰² to illustrate how preferences will change from user to user in the given market.

Graph 1



As explained above:

When $U_{BUY} \geq 0$, circumvention will occur when:

$$U_{CIRC} > U_{BUY}$$

When $U_{BUY} < 0$, circumvention will occur when:

$$U_{CIRC} \geq 0$$

³⁰² Note the distinction between the willingness to pay for an original (V_o) and the willingness to pay for a circumvention device (C_{DEVICE}^{MAX}). The V_o variable represents the value of the original product, to the user. The willingness to pay for a circumvention device, however, represents the value of the circumvention device, to the user.

So the given $C_{\text{DEVICE}}^{\text{MAX}}$ curve, up until the highest point, is derived from the maximum device price that the user can bear, while retaining a positive utility of circumventing (U_{CIRC}).³⁰³ It rises up, until there is a transition at the maximum point, which is where $V_O = P_O + C_O$, or where U_{BUY} is zero.

From this point onwards buying becomes a possible alternative for the user, so the $C_{\text{DEVICE}}^{\text{MAX}}$ curve is derived from the maximum device price that the user can pay, while maintaining a utility of circumventing (U_{CIRC}) that is greater than their utility of buying (U_{BUY}).³⁰⁴ This means that the requisite level of U_{CIRC} is increased from this point. Users will, therefore, be willing to pay less for a device, so the $C_{\text{DEVICE}}^{\text{MAX}}$ curve begins to slope downwards.³⁰⁵

Put simply, this curve is based on the value of U_{CIRC} minus positive U_{BUY} . This value is termed the 'Net Utility' for this paper. This Net Utility concept will be used throughout the results section to illustrate the relative benefit of

³⁰³ When U_{BUY} is negative, buying is not a rational alternative to circumvention, so the net utility will simply be the utility of circumvention (U_{CIRC}). However, once U_{BUY} becomes positive, it becomes a competing option, and net utility will equal the utility of circumvention (U_{CIRC}) less the utility of buying (U_{BUY}).

³⁰⁴ Recall from the relationships explained under Graph 1, that the decision to circumvent will require U_{CIRC} to exceed U_{BUY} when buying is a rational option; that is, when it is greater than zero.

³⁰⁵ In very limited circumstances, α may be greater than 1. If this is the case, then the results given here would not be applicable, as any user who has the capability, and a sufficiently low cost, would circumvent and illegally copy or access the work. As V_O increases, U_{BUY} will increase at the same rate, but U_{CIRC} will increase at an even greater rate. This means that the bend in the net utility curve would not be nearly as dramatic, and net utility would continue to increase with the willingness to pay for an original (V_O). This would make anti-circumvention laws even less effective.

circumventing for users, and to demonstrate what action a user will take, and when.

As illustrated in Graph 1, users who value the original product (V_O) between the two intersection points will be able to buy devices at the minimum market price ($B_{\text{FINC}}^{\text{MIN}}$), and keep a positive utility of circumventing (U_{CIRC}). That is, they will buy devices, and will keep the market open.

While the $C_{\text{DEVICE}}^{\text{MAX}}$ curve remains above the $B_{\text{FINC}}^{\text{MIN}}$ line, the market for devices will be open. To close the market, the minimum provider price must be raised above the maximum point on the $C_{\text{DEVICE}}^{\text{MAX}}$ curve. The horizontal gold line illustrates the requisite level.

The vertical orange line locates the V_O value at which the device is valued the highest. This point is where the user has a utility of buying (U_{BUY}) of zero, and buying becomes an alternative. After this maximum point, U_{BUY} increases in direct correlation with the V_O variable, however, the U_{CIRC} value only increases by a factor of α .³⁰⁶

³⁰⁶ This correlation causes the gradient of the $C_{\text{DEVICE}}^{\text{MAX}}$ curve to become negative and eventually intersect with the $B_{\text{FINC}}^{\text{MIN}}$ line, again.

[4.4.1.1] WITHOUT ANTI-CIRCUMVENTION LAWS³⁰⁷

Based on the assumptions and values justified above, the maximum price users will pay and the minimum price providers can charge for a device or service, are calculated and displayed in the table below.

Results Table 5

	Maximum Price Market Will Pay ($C_{\text{DEVICE}}^{\text{MAX}}$)	Minimum Provider Price ($B_{\text{FINC}}^{\text{MIN}}$)	Difference	$C_{\text{DEVICE}}^{\text{MAX}}$ Divided by $B_{\text{FINC}}^{\text{MIN}}$
Without Laws				
2. Mod-chip	\$552.41	\$33.65	\$518.76	1642%
3. ProBuster	\$60.91	\$0.44	\$60.46	13777%
4. Crackman	\$195.97	\$40.62	\$155.36	483%

By examining the above table and graph, it seems clear that, without anti-circumvention laws, the markets are very much open and operating. The user demand and the costs of supply are so disparate that ProBuster providers could charge 138 times their minimum price ($B_{\text{FINC}}^{\text{MIN}}$), and a small group of users would still buy; so the market would remain open. Similarly, mod-chip providers could charge 16 times their $B_{\text{FINC}}^{\text{MIN}}$, and Crackman dongle providers could charge almost 5 times their $B_{\text{FINC}}^{\text{MIN}}$.

³⁰⁷ Copyright laws remain in effect. Only the effects of anti-circumvention laws are removed from the utility equation.

Results Table 6

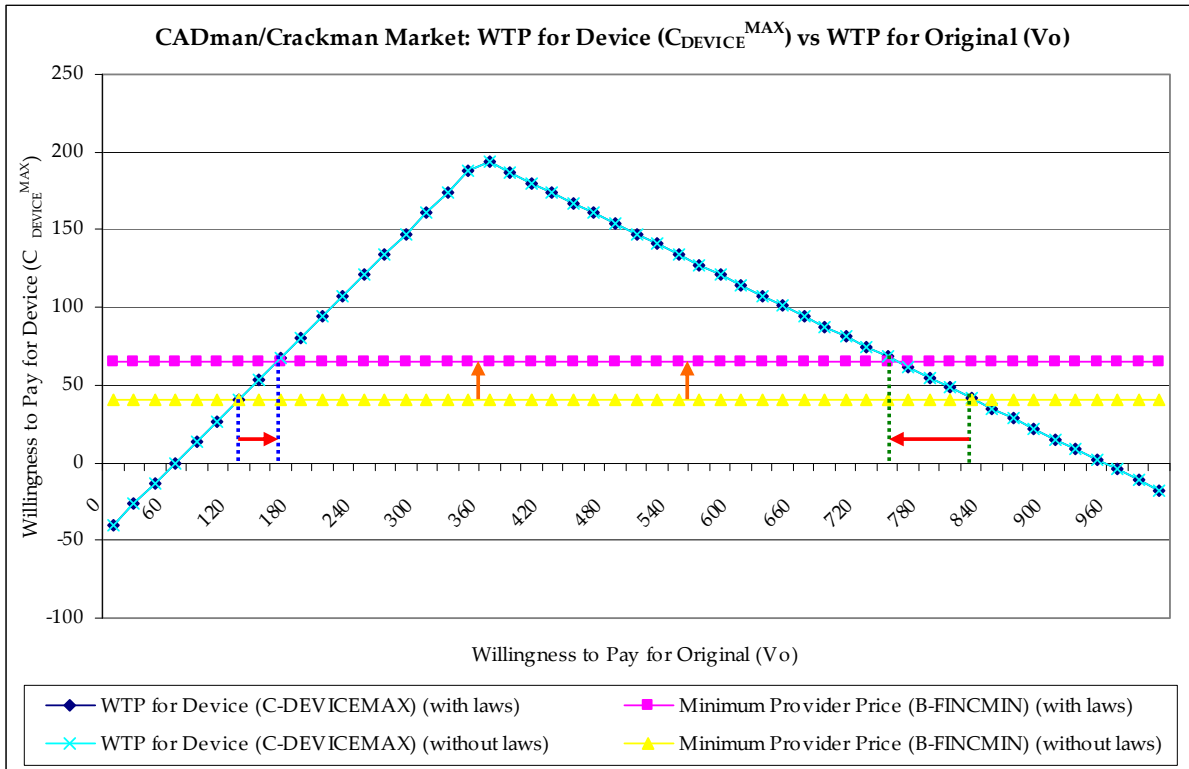
	Minimum value the user must obtain from the product (V_o) to bother circumventing (Intercept 1)	Minimum value the user must obtain from the product (V_o) to prefer buying over circumventing (Intercept2)	Range Size
Without Laws			
2. Mod-chip	\$24.87	\$149.71	\$124.84
3. ProBuster	\$2.14	\$275.60	\$273.47
4. Crackman	\$120.50	\$823.16	\$702.66

So it appears that there is a largely popular and highly lucrative market running. Without anti-circumvention laws, PlayStation users like the one in the example will pay for the mod-chipping service as long as they value (V_o) original PlayStation games between \$24.87 and \$149.71. Considering that the original price (P_o) is \$60, it seems that this range would encompass a considerable portion of the market. Similarly, the V_o range for the DesignPro market is from \$2.14 to \$275.60, with an original price of \$90; and the CADman range stretches from \$120.50 to \$823.16, and its original price is \$250.

[4.4.1.2] WITH ANTI-CIRCUMVENTION LAWS

As anti-circumvention laws increase the costs of providing, providers must increase their prices to retain a positive utility and continue providing. This is illustrated in the below graph, where the minimum provider price ($B_{\text{FINC}}^{\text{MIN}}$) increases and the group of device buyers decreases.

Graph 2



The light blue and dark blue plots indicate that the user’s willingness to pay for a circumvention device or service (C_{DEVICE}^{MAX}) is left fairly unchanged by anti-circumvention laws. The C_{DEVICE}^{MAX} curve is only reduced by the diminutive user law cost variable ($p_{CIRC} \times C_{AC-LAW}$). The provider’s minimum price (B_{FINC}^{MIN}), on the other hand, is increased significantly, and this stops some users from buying circumvention devices and services.

Results Table 7

	Maximum Price Users Will Pay ($C_{\text{DEVICE}}^{\text{MAX}}$)	Without Laws	With Laws	Change in Minimum Provider Price	$C_{\text{DEVICE}}^{\text{MAX}}$ Divided by $B_{\text{FINC}}^{\text{MIN}}$
		Minimum Provider Price ($B_{\text{FINC}}^{\text{MIN}}$)	Minimum Provider Price ($B_{\text{FINC}}^{\text{MIN}}$)		
2. Mod-chip	\$552.41	\$33.65	\$64.49	\$30.84	857%
3. ProBuster	\$60.91	\$0.44	\$3.15	\$2.71	1931%
4. Crackman	\$195.97	\$40.62	\$64.60	\$23.99	303%

As Results Table 7 shows, none of the device markets are closed by the introduction of anti-circumvention laws, as the maximum price users will pay still exceeds the minimum price providers can provide for. Indeed, the two figures are still so far separated that ProBuster providers could charge up to 19 times their $B_{\text{FINC}}^{\text{MIN}}$ and some users would still buy their devices. Similarly, mod-chip providers could charge more than 8 times their $B_{\text{FINC}}^{\text{MIN}}$ and Crackman providers could charge up to 3 times their $B_{\text{FINC}}^{\text{MIN}}$.

This is clear evidence that anti-circumvention laws do not close the market for commercially-provided circumvention devices. This means that commercial providers are not stopped, so the inner to outer-circle transfer of circumventive capability will continue.

[4.4.2] Circumvention Products and Services Provided Freely

As non-commercial providers supply circumventive capability for free, the C_{DEVICE} variable for users of their devices or services will depend on the time taken to find and acquire the circumventive capability, rather than the price charged (B_{FINC}).³⁰⁸

However, as detailed in the previous section,³⁰⁹ anti-circumvention laws deter only a small number of providers, which means that DVD Shrink will not be noticeably harder to find. This means that anti-circumvention laws will not lengthen the time that users take to acquire a device, and therefore will not increase users' device acquisition costs (C_{DEVICE}).

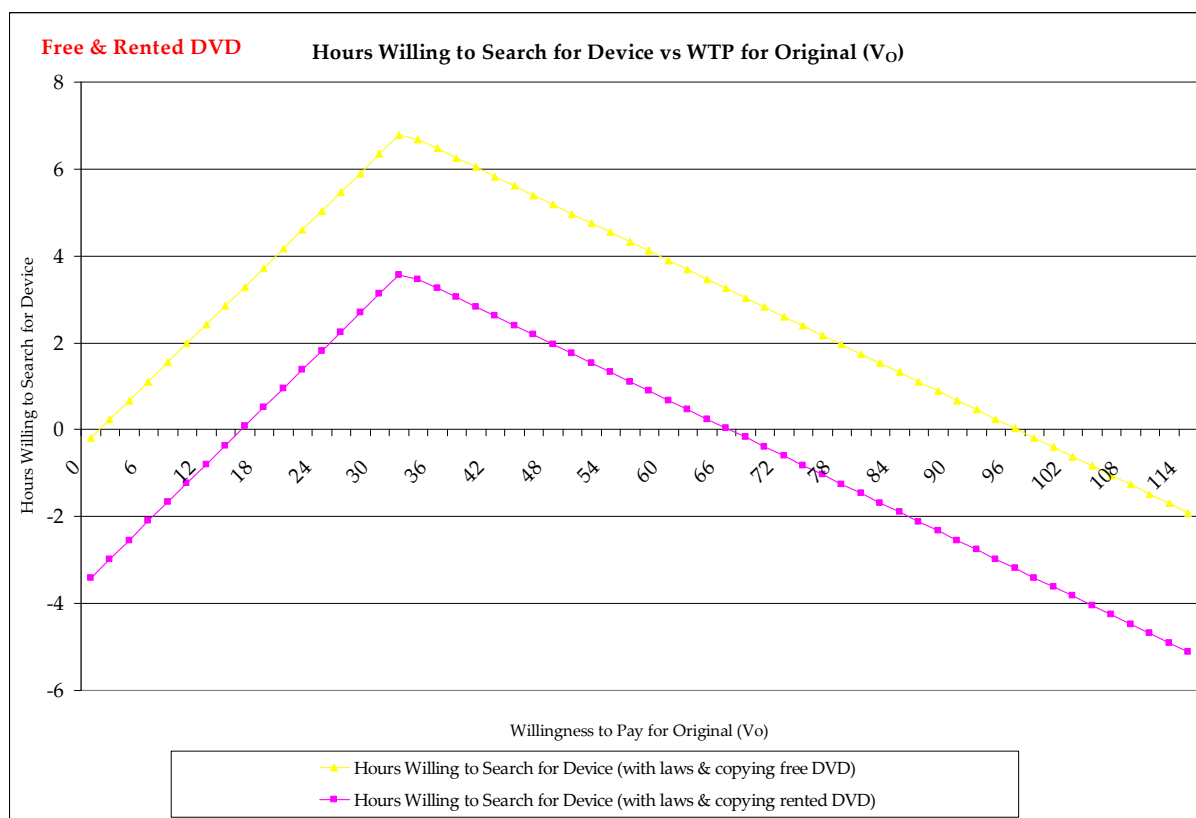
But even if there was a substantial effect on the number of providers, the benefits of circumventing CSS are so great that users, as economically rational actors, will spend up to 3 hours and 39 minutes searching for DVD Shrink.

³⁰⁸ See section 2.3.3.2 at page 62 above.

³⁰⁹ See section 4.3.2 at page 139 above.

Moreover, Graph 3 illustrates that the maximum device acquisition time is increased to 6 hours and 52 minutes, if the user can reduce his or her partnering cost ($C_{PARTNER}$) to zero, by getting a DVD from a friend.³¹⁰

Graph 3



The actual search time depends largely on the number of providers and the technological capabilities of the user. However, it has been established that

³¹⁰ This maximum search time would increase greatly if the number of DVDs copied exceeded the ten copied in this example. This figure was estimated very conservatively to reduce the benefits of circumvention, and thus favourably portray the effect of anti-circumvention laws. However, consider the more realistic case of users who copy 50 DVDs in their lifetime. If the users had to rent the DVD movies, the maximum device acquisition time would be 18 hours. But if the users could borrow the DVD movies from a friend, the maximum device search time would exceed 34 hours.

anti-circumvention laws do not remove a significant number of DVD Shrink providers; so technological capability will be decisive.

Technological aptitude will vary widely across the market, but given that search times of up to 7 hours permit a positive utility of circumvention (U_{CIRC}), only minimal computer and internet familiarity is required.

Furthermore, necessary search times for the entire market should gradually shift down over the next 5 to 10 years, as the population becomes more familiar with computers, the internet and search engines.³¹¹

These results seem to indicate that users and providers of software-based, non-commercial circumvention devices, like DVD Shrink, will be largely unaffected by anti-circumvention laws. Therefore, it is apparent that Australian users will appreciate continued access to these free, software-based circumvention devices, and that this market will not be closed by anti-circumvention laws alone.

³¹¹ There are still many Australians who are unfamiliar with how circumvention devices are to be acquired. This means that they will have very high search times, and device acquisition costs (C_{DEVICE}), which may cause a negative utility of circumvention (U_{CIRC}). However, once these users develop the skills to open a web browser and use a search engine to find a device, their device acquisition costs (C_{DEVICE}) will reduce dramatically and they may appreciate positive utilities of circumventing (U_{CIRC}).

[4.5] How Users are Affected by Increased Prices For Circumvention Devices and Services

Even though anti-circumvention laws cannot close the circumvention device markets; laws rarely can close the market for illicit items completely.³¹² However, this section will demonstrate that anti-circumvention laws do not even cut out a substantial portion of the device user market; as they do not increase costs to a level at which a significant number of users' utilities (U_{CIRC}) become negative.

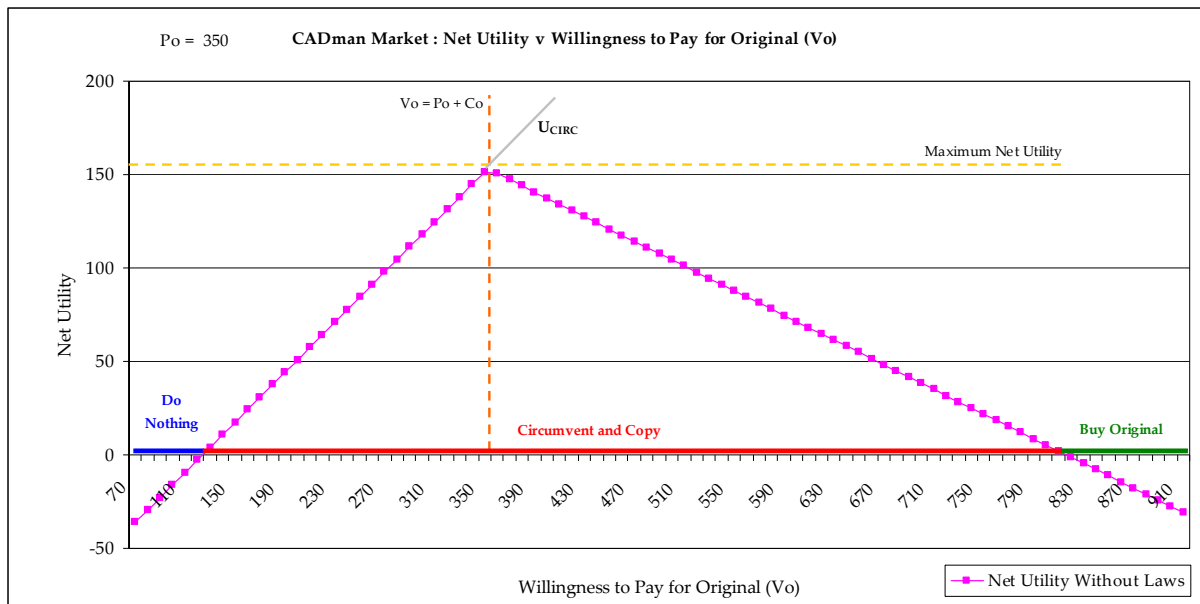
The following graphs depict the net utility, as defined above,³¹³ against the willingness to pay for an original (V_0), to illustrate how anti-circumvention laws shift the utility of circumvention down for all users in the market, regardless of their valuation of the product.³¹⁴

³¹² Even when the death penalty is imposed and the punishment cost (C_{LAW}) is notionally infinite, some illegal markets can not be closed.

³¹³ See section 4.4.1 at page 141 above.

³¹⁴ The grey line extending from the apex represents where the U_{CIRC} curve would progress, if buying was not an option.

Graph 4



As Graph 4 illustrates, there are two points where the Net Utility curve intersects with the x-axis.

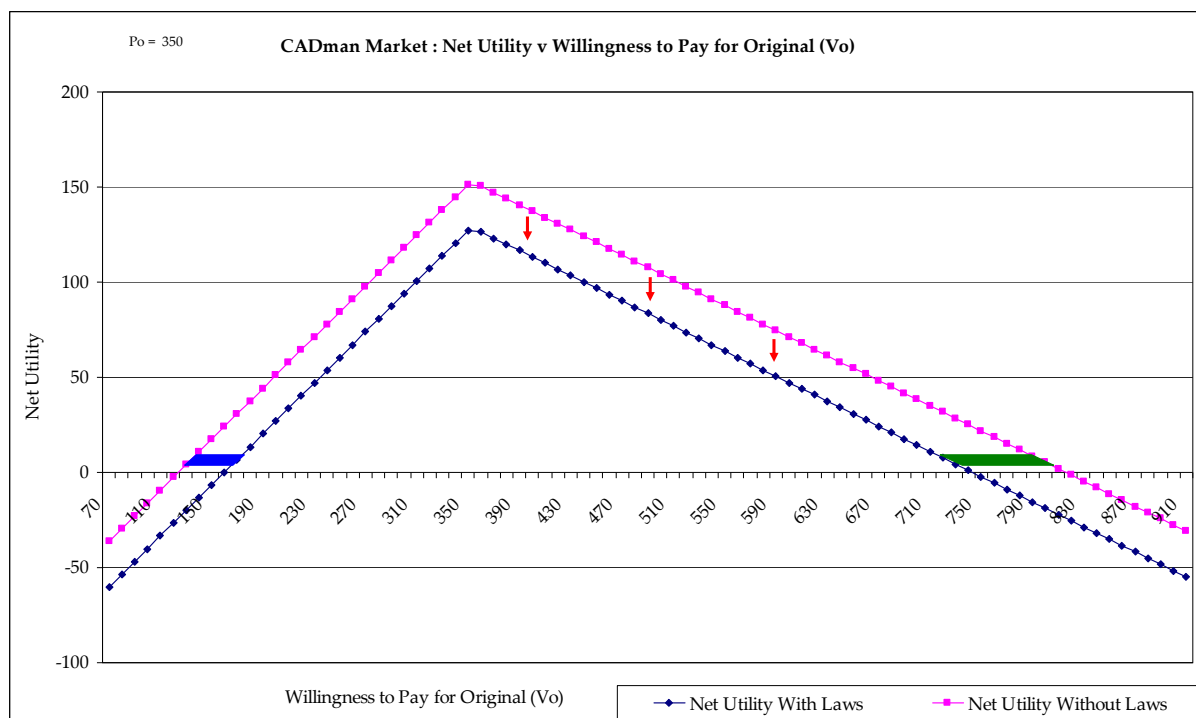
Where a person values the original product (V_o) below the first intersection, both the utility of circumventing (U_{CIRC}) and the utility of buying (U_{BUY}) are negative. So the individual will not even bother copying the product, or using it illegally, as the cost of doing so exceeds their resultant benefit.

However, consumers who value the original between the two intersections will have positive U_{CIRC} values that are also greater than their U_{BUY} values. These individuals will circumvent, as this renders a greater benefit for them than buying the original, or not using the product at all.

Users who value the original product above the second intersection will have a positive U_{BUY} that exceeds their U_{CIRC} , so they will not circumvent, but will buy an original product, as they will appreciate greater benefits from using the work legally, than illegally copying or accessing it.

Given this information, the displacement between the two intersection points must be reduced, in order to recover a portion of the market. This reduction can be achieved by decreasing the utility of circumventing.³¹⁵

Graph 5



³¹⁵ The intersection displacement may also be reduced by increasing the utility of buying (U_{BUY}); however anti-circumvention laws have no bearing on U_{BUY} or its explanatory variables. The utility of buying equation is $U_{BUY} = V_O - P_O - C_O$. So to improve U_{BUY} copyright owners would have to reduce the prices of their products, or the cost involved in acquiring them, or provide better products that, as a consequence, are valued more highly by users.

As one can see from Graph 5, anti-circumvention laws effectively shift the net utility curve downward, and thus shrink the group of individuals who circumvent and illegally access or copy. The above graph, taken from example 4, also demonstrates that anti-circumvention laws effectively deter Crackman users who value the original CADman software between the left intercepts \$124.05 and \$159.86, or between the right intercepts \$743.26 and \$815.95. The other results are summarised below.

Results Table 9

USER	Reclaimed Range						Total Range Size	Original Price	Size as % of Po
	LOW VALUERS			HIGH VALUERS					
	From	To	Size	From	To	Size			
1. DVD Movies	\$10.08429	\$10.08431	\$0.00002	\$77.64704	\$77.64701	\$0.00003	\$0.00005	\$30	0.0002%
2. PS2 Games	\$19.56	\$22.12	\$2.56	\$149.31	\$144.12	\$5.1926	\$7.75	\$60	13%
3. DesignPro	\$2.14	\$6.18	\$4.05	\$275.60	\$267.38	\$8.2208	\$12.27	\$90	14%
4. CADman	\$124.05	\$159.86	\$35.80	\$815.95	\$743.26	\$72.6898	\$108.49	\$350	31%

There are two groups of users that are deterred from circumvention; low-valuers, as depicted in Graph 5's blue area, and high-valuers, who fall in the green area. The users who value the product lowly will not buy, even if they are effectively dissuaded from circumventing and copying. This means that, even though these participants are deterred, no sales are reclaimed, so no direct gain is appreciated by the copyright owner.³¹⁶

³¹⁶ 'Network' and 'neighbouring' effects can play a part in this situation. See the discussion in note 229 above.

The real benefits come from reclaiming the users in the green section, who would otherwise buy. These users, if deterred from circumventing, would constitute a portion of regained demand and would boost copyright owner revenues and profits.³¹⁷ Therefore, in the pursuit of evaluating the changes in copyright owner welfare, the ensuing analysis focuses on the deterred high-valuers.

[4.5.1] *A Significant Portion of the Market?*

There is an undeniable improvement in the position of copyright owners, but the extent of this improvement must yet be examined. Two assessments must be made regarding the reclaimed users. Firstly, whether the change in the intercept displacement is significant, and secondly whether the willingness to pay (V_0) levels will apply to a substantial portion of the market. In other words, whether the shift in utility reclaims a significant number of users, and thus also a significant number of sales. This section demonstrates why anti-circumvention laws do not reclaim a significant number of sales, and thus do not cause a noteworthy improvement in the position of the copyright owner.

³¹⁷ John Rothchild details more thoroughly the benefits gained by copyright owners, when demand is recovered. See generally, Rothchild, above, note 18.

Firstly, the final column of Results Table 9, shown above, indicates that for all except the DVD example, the regained V_o range is of significant size.³¹⁸

So, given that a significant portion of willingness to pay values (V_o) has been reclaimed, an assessment must now be made regarding the actual number of users who fall into this reclaimed V_o range.

Results Table 10

USER	<i>HIGH VALUERS</i>			Original Price	Range Start WTP as % of Po	Range End WTP as % of Po
	<i>From</i>	<i>To</i>	<i>Size</i>			
2. PS2 Games	\$149.31	\$144.12	\$5.19	\$60	240%	249%
3. DesignPro	\$275.60	\$267.38	\$8.22	\$90	297%	306%
4. CADman	\$815.95	\$743.26	\$72.69	\$350	212%	233%

As the above table shows, the only users that are reclaimed are those who value (V_o) the original product at 2 to 3 times the actual price. That is, PlayStation gamers who are willing to pay at least 240 per cent of the actual price, \$144, DesignPro users who would pay 3 times the original price, \$270, and CADman software users who value the product at 2.1 times the original price, or \$735.

³¹⁸ As explained earlier, the providers and users of DVD Shrink are not significantly affected by anti-circumvention laws. See section 4.4.2 at page 149 above.

Realistically, there will be very few users who would pay two or three times the actual product price. If the market's demand was inelastic for price increases of between 100 and 200 per cent, copyright owners would presumably raise their prices to appreciate higher profits.³¹⁹ That is, assuming a reasonably informed market; semi-strong market efficiency will drive all copyright owners to acquire maximised profits, by appropriately pricing their products. In other words, if the price could be substantially raised to improve copyright owner profits, it would have been done already.³²⁰

$$\text{Profit} = (\text{Price} \times \text{Quantity}) - \text{Costs}$$

The above equation indicates that, because the price cannot be increased further without reducing profit, either the quantity demanded must decrease or the costs must increase dramatically. For digital copyright products, the costs will only increase with the very low marginal cost of production; so, in this case, quantity must decrease at a greater rate than price increases. Where

³¹⁹ For instance, if a Sony PlayStation game has a modest profit margin of 33 per cent, or \$20, and its price could be raised to the 212 per cent value needed here; it would then have a price of \$127. With the same \$40 distribution cost, it would now have an \$87 or 218 per cent profit margin. So logically, assuming that Sony has a firm understanding of the console gaming market that it has dominated for the past 13 years, there will be very few users who value PlayStation games this highly.

³²⁰ This argument also assumes that the copyright owner cannot price-discriminate between customers. So the one price the owner does choose; must provide the superior return.

this is true, the demand is considered price-elastic.³²¹ This does not mean that the demand is elastic at all price levels; however it becomes elastic at the current original price (P_0).

Typically, the limited statutory monopoly granted to copyright owners will make the demand for copyright products less price-elastic than the demand for other products, which can be freely imitated. However, there are still substitutes for nearly all consumer copyright products, which will promote elasticity. These substitutes will not necessarily be perfect, but they will ensure that prices cannot be increased 2 or 3 fold without serious reductions in the quantity demanded.³²² Due to this elasticity, and the availability of substitutes, very few consumers will be willing to pay 2 or 3 times the current price for DesignPro, CADman or PlayStation games.

So it seems that, while a segment of the market is reclaimed, that segment only recovers circumventers who value the product far above its current

³²¹ Price elasticity is a measure of the market's response to changes in price. If the quantity of products demanded decreases faster than the price increases, the market's demand is considered price-elastic. If the quantity of products demanded decreases slower than the price increases, the demand is said to be price-inelastic. Price-inelasticity can allow producers to increase their prices, to appreciate higher profits.

³²² A PlayStation 2's gaming capabilities could be substituted with an Xbox 360, a Nintendo Wii, or a PC. These are not perfect substitutes, as the available games, processing power and game-play may vary. Similarly an Arnold Schwarzenegger action film may be imperfectly substituted with a Sylvester Stallone film, and 3D Studio Max may be substituted with Maya. While these aren't perfect substitutes, the availability of these competing products increases the price-elasticity of demand for each of the consumer markets, because once prices for one product become extreme, consumers will defect to substitutable products.

market price. Therefore, it is probable that there are too few users in that segment, to make any real difference to copyright owner revenues or profits.

5 SOLUTIONS

The results presented above indicate that anti-circumvention laws are largely ineffective at reducing the supply of circumventive capability, and the instances of circumvention. However, given the explanations in chapter 1, the idea of supporting TPMs, with legal protection, is not fundamentally flawed. So one may question whether the effect of anti-circumvention laws could be boosted, such that they would close the circumvention device market, or deter a substantial number of circumventers.

To accomplish a superior result, the utility of contravention would have to be reduced, and anti-circumvention laws may only do this by increasing the law cost variable ($p \times C_{AC-LAW}$) for users or providers.

Firstly, it is unlikely that the user and provider criminal punishments will be increased significantly. In one sense, it would be fairly easy to increase $C_{AC-CRIM}$, because this would only involve changing a few numbers in the legislation.³²³ But the criminal provider punishment of 550 penalty units and 5 years in prison is equal to the greatest of any other penalties imposed under the Act. And the newly introduced circumvention offence is still quite fresh

³²³ But if C_{AC-LAW} is too high, judges and juries may be reluctant to convict contraveners, or serve them the maximum remedy. See, Becker, above, note 15, at 184.

and radical.³²⁴ So the level of $C_{AC-CRIM}$ is, arguably, already at the maximum level that the Australian Government is willing to impose.³²⁵

Similarly, the user and provider costs of civil punishment ($C_{AC-CIVIL}$) are tied to common law, which has developed over many years, with Australian copyright cases.³²⁶ It is impossible to change this common law overnight, so changing the cost of civil punishment, for providers or users, will not be an option.³²⁷

³²⁴ Some argue that the s 116AN prohibition on circumventing access control TPMs has effectively given copyright owners a right to control access; which has never before been conceded. This has caused some consternation, as it is considered a further expansion of copyright protection. See, Weatherall (2004b), above, note 8, at 626-632; De Zwart, above, note 8, at 10; Fitzgerald, above, note 5.

³²⁵ This unwillingness also stems from the atypically high punishments for copyright offences, relative to other white collar crimes. For instance, the maximum criminal punishment of 550 penalty units and 5 years imprisonment, for providing circumvention devices, is nearly as high as those for embezzling corporate funds, under s 209(3) of the *Corporations Act 2001* (Cth), or dishonestly breaching director's duties, under s 184 of that Act. These remedies may extend to a maximum of 2,000 penalty units and 5 years imprisonment, according to Schedule 3 of the *Corporations Act 2001* (Cth). However, they cost more people, much greater sums of money, are far more damaging to society.

³²⁶ This common law stipulates that one of the two main elements in a damages remedy is compensatory, and thus will be limited to copyright owner loss. It also limits the levels of additional damages to be imposed, to ensure an adequate, non-excessive punishment.

³²⁷ To alter the civil punishment, total reform would be necessary. The current civil copyright remedies are based largely on compensation; and compensation is only as great as the copyright owner's loss. So, to increase the potential civil remedies, their derivation would have to be separated from compensation and refocused towards punishment. The USA has civil statutory damages set for copyright infringements at a maximum of US\$30,000 per infringement, or US\$150,000 per willful infringement. This sort of system could be applied to anti-circumvention laws to increase civil penalties for both users and providers immediately. However, there has been much abuse of these incredibly large statutory damages in the USA. The RIAA, in particular, has used the huge figures to frighten innocent individuals into settling cases, for fear of multi-million dollar lawsuits. See, *Copyrights* 17 USC s 504(c) (2006): <http://www4.law.cornell.edu/uscode/html/uscode17/usc_sec_17_00000504----000-.html> (4 Sep 2007); McLaughlin K, 'Mother Fights Record Companies' Lawsuit on Her Own', *USA Today*, 25 December 2005: <http://www.usatoday.com/news/nation/2005-12-25-download-suit_x.htm> (1 Aug 2007); McCall W, 'Woman Targets RIAA with Lawsuit',

Given that the punishment cost elements cannot realistically be increased to a significant degree,³²⁸ the perceived probability of being punished (p) must be improved for anti-circumvention laws to more effectively meet their objectives. However, several points should be noted.

First, unlike C_{AC-LAW} , improving actual p requires massive expenditures; as greater enforcement necessitates more police, judges, courts and juries, which are very costly to the government.³²⁹ Alternatively, the p variable could be increased through a 'scare campaign', which would make the perceived p greater than the actual p, by misinforming consumers and using erratic, extremist enforcement techniques.³³⁰ Such schemes have, however, had limited success in the past,³³¹ and have caused considerable public backlash.³³²

Associated Press, 29 August 2007:

<<http://www.forbes.com/feeds/ap/2007/08/29/ap4065797.html>> (4 Sep 2007); Lessig, above, note 37, at 185, 200.

³²⁸ At best, an arbitrary increase in punitive damages could be achieved, but this could result in considerable public backlash. See, Moses, above, note 268.

³²⁹ Kendall & McNamara, above, note 12, at 140.

³³⁰ The RIAA has been doing this for some time. See, 'RIAA Leaning on Kids' Parents', *Associated Press*, 24 July 2003:

<<http://www.wired.com/entertainment/music/news/2003/07/59756>> (1 Aug 2007); Webb C, 'RIAA Rocks Around the Clock', *Washington Post*, 1 August 2003:

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<<http://www.wired.com/entertainment/music/news/2003/09/60341>> (1 Aug 2007); Moses, above, note 268.

³³¹ See note 336 below.

³³² These campaigns can also have potentially disastrous affects for public relations. See, Moses, above, note 268; McLaughlin, above, note 327; McCall, above, note 327.

Second, it must be noted that the p values used in this investigation are already incredibly high, and these figures probably could not be achieved in reality.³³³ There are two reasons for this; the number of prosecutions is low, and the number of contraveners is high.³³⁴ Firstly, there are millions of consumer-level circumventers and copiers,³³⁵ and the enforcement-elasticity of the demand for copies is very low.³³⁶ Additionally, the copyright owner faces great difficulty and expense in proving and winning a copyright case;³³⁷ and even if victorious, it can be a laborious task extracting the awarded payments from the contravener.³³⁸

It thus seems probable that the costs of increasing p would outweigh the benefits so greatly, that it would be unjustified for copyright owners or the

³³³ See section 3.2.8 at page 99 above.

³³⁴ Recall from section 3.4.7 at page 118, that the enforcement rate is derived by dividing the number of prosecutions by the number of contraventions.

³³⁵ Kendall & McNamara, above, note 12, at 126.

³³⁶ This, put simply, means that even when enforcement rates increase, people will still choose to contravene. This was indicated by a Jupiter Research investigation, which analyzed European file-sharing during the IFPI's lawsuit campaign. The investigation found that broadband penetration increased from 21 per cent of households in 2002, to 40 per cent of households in 2006, while the percentage of internet users who regularly download music illegally on file-sharing networks remained steady at about 15 per cent. While this means that the level of file-sharing did not increase, proportionate to the number of internet users, it most certainly did increase in an absolute sense. If there are twice as many broadband users and still 15 per cent of them file-share, then the number of file-sharers will also have doubled. This would indicate that the IFPI's legal 'scare-campaign' was ineffective at increasing the entire market's perceived p . See, International Federation of the Phonographic Industry (2007a), above, note 123, at 18; International Federation of the Phonographic Industry (2006), above, note 123, at 4; International Federation of the Phonographic Industry (2007b), above, note 266, at 19.

³³⁷ Australian copyright remedies are also typically quite low. See, Kendall & McNamara, above, note 12, at 122.

³³⁸ Some contraveners are even invulnerable to civil prosecution, because of their financial status. See, Kendall & McNamara, above, note 12, at 126, 128.

Government to invest their efforts towards accomplishing it. Therefore, it is apparent that the results shown here depict anti-circumvention laws in their most favourable light; hence, their effect could not realistically be amplified further.

6 CONCLUSION

The objective of anti-circumvention law is to support copyright owner interests indirectly, by providing legal protection for TPMs. This legal protection is achieved by prohibiting the circumvention of access control TPMs, and by restricting the transmission of circumvention devices from the inner circle to the outer circle.

Applying economic models to Australian anti-circumvention laws, across a range of typical present-day scenarios, yields some fairly consistent results on behaviour. These laws do not significantly reduce the non-commercial supply of circumvention devices, as non-commercial providers are typically unaffected by the laws. The results also indicate that the demand for circumventive capability is so high, that commercial providers can raise the prices of their devices and services, to overwhelm any cost increases imposed by anti-circumvention laws. Therefore, anti-circumvention laws will never close the commercial or non-commercial circumvention device or service markets; though it may be unrealistic to expect a law to do so.

The model results have also indicated that, because of the ineffectiveness of the user laws, and the inability to close the circumvention device market; anti-

circumvention laws will generally not deter a substantial number of users from circumventing and engaging in piracy.

Overall, these results indicate that anti-circumvention laws do not significantly reduce the levels of circumvention or piracy, and therefore do not meet their policy objectives.

Two final points can be made about the models developed in this thesis and potential areas for further research. First, the accuracy of any model will depend on its verisimilitude and on the data entered into it. The models have been elaborated upon and finely honed to best represent the Australian reality. However, one limitation in this area is the availability of devices from providers, who are outside Australian legal jurisdiction, and thus outside the models. While it limits the predictive power of the models, this point only affirms this thesis. This limitation indicates that the supply of devices is even more difficult to extinguish, and that even if Australian provider costs were effectively increased, user device acquisition costs would not necessarily increase at the same rate.³³⁹

³³⁹ That is, user costs may increase more slowly than provider costs, as some users may purchase their devices from foreign providers, who impose lower costs on them.

Second, one fruitful area for further research would be improving the data used in the models. By gathering precise empirical evidence on the models' variables, new insight would be given into exactly which factors are most powerful, and how to best alter the utilities of copying and circumvention.³⁴⁰

³⁴⁰ This will, however, necessitate the cooperation of a large sample of illegal users and providers; the acquisition of which may be remarkably difficult.

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APPENDIX

p = 5%
p of no punishment = 95%

Contraventions per period	p per period
0	0.00000%
1	5.00000%
2	9.75000%
3	14.26250%
4	18.54938%
5	22.62191%
6	26.49081%
7	30.16627%
8	33.65796%
9	36.97506%
10	40.12631%
20	64.15141%
30	78.53612%
40	87.14878%
50	92.30550%
100	99.40795%
200	99.99649%
300	99.99998%
400	100.00000%
600	100.00000%
800	100.00000%
1000	100.00000%
2000	100.00000%

p = 1%
p of no punishment = 99%

Contraventions per period	p per period
0	0.00000%
1	1.00000%
2	1.99000%
3	2.97010%
4	3.94040%
5	4.90100%
6	5.85199%
7	6.79347%
8	7.72553%
9	8.64828%
10	9.56179%
20	18.20931%
30	26.02996%
40	33.10282%
50	39.49939%
100	63.39677%
200	86.60203%
300	95.09591%
400	98.20494%
600	99.75950%
800	99.96778%
1000	99.99568%
2000	100.00000%

p = 0.1%
p of no punishment = 99.9%

Contraventions per period	p per period
0	0.00000%
1	0.10000%
2	0.19990%
3	0.29970%
4	0.39940%
5	0.49900%
6	0.59850%
7	0.69790%
8	0.79721%
9	0.89641%
10	0.99551%
20	1.98111%
30	2.95690%
40	3.92298%
50	4.87944%
100	9.52079%
200	18.13512%
300	25.92930%
400	32.98141%
600	45.13531%
800	55.08509%
1000	63.23046%
2000	86.48001%

p = 0.05%
p of no punishment = 99.95%

Contraventions per period	p per period
0	0.00000%
1	0.05000%
2	0.09997%
3	0.14993%
4	0.19985%
5	0.24975%
6	0.29963%
7	0.34948%
8	0.39930%
9	0.44910%
10	0.49888%
20	0.99526%
30	1.48918%
40	1.98062%
50	2.46962%
100	4.87825%
200	9.51852%
300	13.93243%
400	18.13102%
600	25.92374%
800	32.97470%
1000	39.35452%
2000	63.22125%

p = 0.01%
p of no punishment = 99.99%

Contraventions per period	p per period
0	0.00000%
1	0.01000%
2	0.02000%
3	0.03000%
4	0.03999%
5	0.04999%
6	0.05999%
7	0.06998%
8	0.07997%
9	0.08996%
10	0.09996%
20	0.19981%
30	0.29957%
40	0.39922%
50	0.49878%
100	0.99507%
200	1.98023%
300	2.95559%
400	3.92125%
600	5.82383%
800	7.68873%
1000	9.51671%
2000	18.12774%

p = 0.005%
p of no punishment = 99.995%

Contraventions per period	p per period
0	0.00000%
1	0.00500%
2	0.01000%
3	0.01500%
4	0.02000%
5	0.02500%
6	0.03000%
7	0.03499%
8	0.03999%
9	0.04499%
10	0.04999%
20	0.09995%
30	0.14989%
40	0.19981%
50	0.24969%
100	0.49876%
200	0.99504%
300	1.48884%
400	1.98018%
600	2.95552%
800	3.92115%
1000	4.87718%
2000	9.51648%

p = 0.001%
p of no punishment = 99.999%

Contraventions per period	p per period
0	0.00000%
1	0.00100%
2	0.00200%
3	0.00300%
4	0.00400%
5	0.00500%
6	0.00600%
7	0.00700%
8	0.00800%
9	0.00900%
10	0.01000%
20	0.02000%
30	0.03000%
40	0.03999%
50	0.04999%
100	0.09995%
200	0.19980%
300	0.29955%
400	0.39920%
600	0.59821%
800	0.79681%
1000	0.99502%
2000	1.98014%

p = 0.000091%
p of no punishment = 99.99991%

Contraventions per period	p per period
0	0.00000%
1	0.00009%
2	0.00018%
3	0.00027%
4	0.00036%
5	0.00046%
6	0.00055%
7	0.00064%
8	0.00073%
9	0.00082%
10	0.00091%
20	0.00182%
30	0.00273%
40	0.00364%
50	0.00455%
100	0.00910%
200	0.01821%
300	0.02731%
400	0.03641%
600	0.05461%
800	0.07280%
1000	0.09100%
2000	0.18191%