

Article

## A Counterfactual Impact Analysis of Fair Use Policy on Copyright Related Industries in Singapore

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**Abstract:** Are more flexible fair use approaches, which require a test for determining whether new uses should be permitted, correlated with economic growth? Using the example of Singapore, we assess the extent to which fair use is related with growth in private copying technology and copyright markets. With reference to a differences-in-differences (DiD) methodology applied to the 2005 fair use amendments of the Singapore Copyright Act we test the law's implications on private copying technology and copyright sectors in Singapore. The modifications of the Singapore Copyright Act were part of a set of changes of its Intellectual Property (IP) laws undertaken in the context of a Free Trade Agreement with the United States. Our findings seem to support the hypothesis that a more flexible fair use policy is correlated with faster growth rates in private copying technology industries. However, the counterfactual impact analysis did not support our second hypothesis, that flexible fair use policy would be correlated with higher growth in the copyright industries (indirectly via the growth of private copying technology industries). Thus, while the growth of copyright industries slowed down to a limited extent after 2005, the industrial group did not experience the degree of negative impact we expected. Moreover, this limited negative impact was offset by the positive impact of fair use policy correlated with higher growth in private copying technology industries. We caution that a counterfactual analysis cannot be used to attribute a causal relationship. It can only establish a correlation between a policy and a given outcome. Our findings must be read in this light. Further research, containing more comprehensive data sets and

possibly also singling out international trade aspects, would benefit the debate on the interplay of copyright law and economic growth.

**Keywords:** exceptions and limitations to copyright law; economic development; high technology; free trade agreements; copyright reform

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## 1. Introduction

The economic impact of implementing flexibility in copyright regimes, such as by imitating US-style fair use style limitations and exceptions to copyright law, has not been adequately captured to date <sup>1</sup>. Recent studies have investigated the contribution of copyright and fair use industries in the context of the national economy [1,2]. These approaches quantify the economic value of fair use by reference to the industries that rely on it. Though this work yields useful quantitative measures of fair use-related industries, it does not capture the full extent of fair use's influence on economic growth and innovation. Our study attempts to advance research in this field by assessing the extent to which implementing fair use or fair-use style legislation stimulates growth in selected high-technology industries and copyright related sectors in Singapore, a country which enjoyed for much of its legal history a very restricted approach to limitations and exceptions to copyright law.

The argument we set out to test here is whether the more flexible fair use approach, which requires a test for determining whether new uses should be permitted, are correlated with economic growth. We assess the extent to which fair use is related with growth in private copying technology and copyright markets. In doing so, we posit that flexible fair use in copyright law has two additional effects in the economy beyond those posited by traditional fair use analyses. Flexible fair use exemptions may: (1) increase the growth rate of private copying technology industries; and (2) increase the growth rate of copyright markets. We test this hypothesis using a differences-in-differences methodology that is applied to the 2005 fair use amendments to the Singapore Copyright Act and test its implications on private copying technology and copyright sectors in Singapore.

Focus here remains on the flexible language of the fair use system found in the USA, which was recently adopted in Singapore in the context of a Free Trade Agreement signed between the United States of America and Singapore. The distinction between fair dealing in countries such as Singapore or India and fair use in the USA is primarily a difference of terms: both terms denote a similar flexible approach to fair use when compared to the specific lists of exceptions to copyright infringement found elsewhere.

In Singapore, all uses of a copyrighted work, except for those uses protected for the purposes of criticism, review and the reporting of current events, are subjected to the five-factor test set out in clause III.35 of the Singapore Copyright Act. Adopting 1 January 2005—the date of ratification of the flexible fair use factor test—as the critical date for fair use amendments in Singapore permits an

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impact evaluation of the influence of fair use on two important industry groups: private copying technologies and copyright industries. Private copying technology industries are defined here as those industries that manufacture and sell technologies—and related electronic components, infrastructure, and services—that enable consumers to record, store, and transmit copyrighted material for their own personal use. Copyright industries are defined as those industries whose primary source of revenue are the reproduction, distribution, publication and sale of copyrighted materials, including film, audio and text. In order to control for other macroeconomic factors that may impact growth trends in these industries, we included a comparable sample of industries in a third group: the control group. This group includes industries not directly affected by the fair use amendments but for which underlying macroeconomic trends are assumed to be similar to the treatment group. It is composed of technology-related manufacturing and consumer electronics industries. Time-series data on industry value added for these groups is aggregated using Singapore's 2010 statistical SSIC classification system, the latest year for which data was publicly available. Charting the growth of these industry groups over the two time periods (before and after fair use amendments) enables us to evaluate the economic impact of fair use, once other macroeconomic factors are accounted for.

## 2. Copyright: A Balance of Interests

The existence of enforceable copyright permits trade in creative contents [3]. The rationale is that, without legal protection, authors would not be able to profit from their efforts and publishers would not be able to recoup the investment necessary to produce and distribute those works to the public. Appropriating the full social value of an information good, such as a book, film, or composition, is difficult because information is a public good, which is both non-rivalrous in consumption and non-excludable. This means that one person's use of information does not stop another's use of it simultaneously and that it is very difficult to exclude others from the use of this information [4]. Information can be freely copied and distributed on a huge scale at virtually zero marginal cost. Perfect copies of books, films, and songs are now regularly distributed on the Internet. This challenge is becoming increasingly problematic due to new copying technologies and is expressed in the *appropriability problem* in copyright [5].

Copyright has increasingly contributed to the evolution of what [6] termed the anti-commons: “when multiple owners have the right to exclude others from taking advantage of a scarce resource, and no one has an enforceable privilege of use, the resource might be underutilized.” [7].

Against this background copyright policy needs to be a delicate balancing act. Economic incentives to create must be balanced against providing adequate access to information goods [8]. From a public policy perspective, it is critical to avoid this anti-commons effect and maintain a balance in copyright. A number of limitations and exceptions to exclusive copyrights have been an essential part of the doctrine from the outset. These exemptions protect users from infringement liability in certain cases and promote public welfare by stimulating greater access to information goods. The most significant set of these exemptions is known as fair use.

### *2.1. Fair Use and Other Limitations and Exceptions: The Balancing Act*

Fair use and other limitations and exceptions establish a boundary to the exclusive rights of rightholders. This is justified on the basis that some uses of copyrighted works should not require the permission of the rightholder or that some markets should not be under their control [9]. Fair use achieves a balance in copyright between various interest groups, promoting the diffusion of information without eliminating incentives to create it. In this sense it is bound to competition policy because it prohibits rightholders from the economic exploitation of particular uses and markets for their works.

Fair use has been conceptualised in several different ways. Some see fair use as a form of compulsory license in which the cost of the license is zero [5]. Some, however, see fair use as a definition of those uses which never belonged to the owner in the first place. Others conceive of fair use as exceptions to the exclusive rights granted to the author. These varying conceptions of fair use—as never part of the author’s exclusive rights, as an exception to their rights, or as a right given to users—are further complicated by uncertainty regarding the scope of uses that fair use is meant to protect in practice.

Fair use exemptions exist for the purposes of criticism and review, the reporting of current events and to support educational and archival services. The flexibility of fair use in the USA is exemplified by the four factor test (presented below), which outlines the factors that courts must consider when judging if a particular use of a copyrighted work is fair, and thus exempt from infringement liability [10]. Flexible fair use statutes enable the doctrine to adapt to new circumstances and technologies without substantial legislative revision. This is an important benefit of flexibility in fair use that may outweigh uncertainty regarding its application. The case-by-case approach exemplified in the USA does not give clear guidance on the interpretation, weight and application of the four fair use factors. This is a deliberate choice in order to give scope to the regulation of dynamic situations and stands in contrast to the rigid approach prevailing in European jurisdictions.

### *2.2. Fair Use and Market Failure Theory*

Many scholars have analyzed past fair use decisions to identify the underlying rationale for its application [11–14]. Fair use is conceptualized in the academic literature as an exception to the exclusive rights of copyright owners that is justified in the face of market barriers including high transaction costs, externalities, non-monetizable benefits—such as strengthening freedom of expression and increasing public access to heritage works—and anti-dissemination motives [15].

Academics conceptualize copyright law as being strongly rooted in market failure theory, which is firmly grounded in neoclassical economics. This approach supports strong, centralized property rights and perceives the market as the most efficient mechanism to allocate resources [9]. Due to the substantial transaction costs of negotiating licenses for individual uses, such as photocopying or backing-up across hard disks, many uses would be prevented if fair use did not resolve this market failure and permit unauthorized use in special circumstances. Fair use enables valuable uses of copyrighted works in circumstances when the value of a use is less than the transaction costs involved in negotiating a license agreement [16]. Fair use thus exists to balance user and rightholder interests in copyright, securing a healthy environment to promote the advance of science and the arts.

### 2.3. Fair Use and Private Copying

Fair use facilitates access to existing works [17]. Copyrighted works are never simply outputs of the creative process but are also an important input for subsequent works. It is logical to assume that increasing the number of works available also stimulates the creation of more works. Citing Scotchmer's (1991) study proving this point for patents [18], Varian argues that it is equally applicable to copyright [14]. But the important point for stimulating creation is not simply that these works exist, but that people have access to them. The creation and dissemination of works is not the ultimate goal of copyright. This, Litman remarks, forgets an essential step: "in order for the creation and dissemination of a work of authorship to mean anything at all, someone needs to read the book, view the art, hear the music, watch the film, listen to the CD, run the computer program, and build and inhabit the architecture" [19].

Copyright exists to promote the progress of science and the arts. This progress relies on the ability of individuals to make reasonable use of prior material [3]. This is especially true for creator's operating in media-saturated environments where information is transmitted on digital networks. Fair use enables us to "stand on the shoulders of giants" by implicitly recognizing that ideas are almost always derivative [20]. Fair use enables copyright to simultaneously fuel the creation of works while also encouraging the public use of those works [9]. Economists identified long ago that there may be a trade-off between the incentives to create intellectual property and the promotion of its efficient use [21]. Scholars suggest that when private copying encourages widespread use it can increase total welfare even if this results in fewer originals being produced [22].

It has been argued that exceptions and limitations to copyright law have an important impact on the dissemination of information and the rate of innovation in modern economies because they establish limits to the exclusive rights of authors [23]. They also protect a number of legitimate uses of a work from the charge of copyright infringement and thus increase the social value of copyrighted goods to users. To provide safeguards to copyright law has been argued to support the social values of democratic society [24], balance the public interest with authors' and promote free speech [25], rectify copyright market failures [26], enable creators to build on the work of others [12] and accommodate established social practices [27].

### 2.4. Fair Use Classes, Private Copying and Innovation

The value of copying technologies to consumers rests on their ability to unlock new value from copyrighted works: each technology relies on, and enhances the total value of existing investments in audio-visual content [28]. An mp3 player is more valuable the larger one's CD collection is. The mp3 player itself also enhances the value of a CD collection by permitting easy transportation. The product ecosystem that emerged around the Apple iPod is often cited as an indicator of how new copying technologies can precipitate highly diverse, and valuable economic activities [28]. The practice of moving copyrighted works through space (across devices) and time (recorded for later viewing), practices labeled space- and time-shifting respectively, is becoming commonplace. By consequence, the ability to enjoy copyrighted works in more ways increases demand for them. New markets for alternative mediums of expression, such as podcasts, e-books, and audiobooks, are more likely to spread as copying technologies proliferate. The availability of such digital technologies stimulates the

growth of a much larger group of potential fair users that are drawn to the reproductive, distributive and adaptive power of new copying technologies [29].

Private copying, whether for social reasons (sharing works with relatives and friends), for backing-up information, or for space- or time-shifting, is an integral aspect of using digital content from the perspective of consumers [30]. This has resulted in a sense of entitlement to make private copies [3]. There is a growing public attitude that favours the unauthorized duplication of copyrighted works in certain circumstances [31]. It may reflect the fact that though the revenue loss to industry as a result of private copying remains insufficiently quantified, the average consumer is not aware of the fact that illegal copying constitutes a crime [32]. As copyright's legal framework diverges from actual consumer practices, consumers do not realize that they may act against the law when illegally downloading content [33].

Academic work on fair use tends to focus on three different classes of problems: (1) *productive* use in which the use is unauthorised but "productive", such as use of copyrighted material for documentary or archival work; (2) *personal* use for the purpose of time- and space-shifting across devices, such as that permitted by mp3 and TiVo; and (3) *transformative* use where copyrighted material is incorporated into new works, exemplified by the user-generated content revolution online [23]. While most fair use debates focus on protecting *transformative* and *productive* uses from copyright infringement, it is the *personal* use class—which unlike the other two classes is a primarily *consumptive* process that does not generate new content—that is far more common. Historically, copyright protected authors against acts of unauthorised communication but it did not protect against consumptive use for personal reasons [3]. The rise of digital technologies has permitted far more widespread *transformative* use as well as facilitating copying for purely *personal*, consumptive reasons.

It is important to distinguish here between *personal* copying, for example copying a song from a computer to an mp3 player, and file-sharing, which can be seen as unauthorised communication across a network. The industry response to file-sharing has been to implement technical protection measures and promote anti-circumvention laws to prohibit all types of digital copying. The ability to copy for *personal* uses has been increasingly restricted during this process despite the fact that copyright did not originally accord this type of control to copyright holders. Fair use has thus become an increasingly important defense for limiting the exclusive rights of copyright owners in order to protect *personal*, primarily consumptive, uses. While fair use does not override the restrictions on content made possible by technological protection measures, which are protected by law against circumvention in many countries including the USA, it remains an important legal concept for protecting personal copying from claims of copyright infringement. The impact of legislation prohibiting circumvention of digital rights management systems has been widely debated and does not warrant further discussion in this paper [11,34–36].

This study assesses the influence of fair use legislation on economic growth in private copying technology industries (for a full list of industries see the Annex), which include technologies that enable both transformative and consumptive uses of copyrighted works. Our definition of consumptive use includes emerging consumer practices such as format-shifting (across file types and media), space-shifting (across devices) and time-shifting (content saved for later enjoyment) as well as more traditional forms of copying such as photocopying. None of these uses can be considered *transformative* in the same way as, for example, the phenomena of user-generated content online.

However, consumptive uses also contribute to the value of copyrights via the processes outlined below. As a result, our definition of *private copying* includes all forms of copying, whether transformative or consumptive, except for illegal file-sharing. These include purely individual uses for personal purposes as well as for educational, critical, archival, or parody purposes. Private copying therefore means, simply, any and all instances in which a consumer copies copyrighted content across time, space and format.

A flexible fair use policy, such as the US fair use doctrine recently used as a model for amendments to Singapore's Copyright Act, may be in a stronger position to adapt to new technologies without substantial legislative revision. This is because this fair use approach enables courts to make decisions based on the four-factor test rather than legal scholars having to predict *ex ante* all of the uses that new technologies might permit. It is this type of *ex ante* restriction that is likely to slow innovation in private copying technology markets and stall their growth. A U.S. type of limitations and exceptions to copyright law is however also not without problems. In practice, the flexibility of fair use clauses may translate into very expensive and lengthy litigation [37–39]. D'Agostino argues: "US Congress has so failed to simplify fair use. The courts have failed to simplify fair use by attempting to establish presumptions (a) that commercial uses are unfair; (b) favoring plaintiff's unpublished works; (c) that works must be transformative to constitute fair use" ([40], p. 4). In a Singaporean context it seems however that the introduction of fair use provided so far an enhanced solution to the restrictive system innovators faced before. To what extent the existing approach will deserve further reform, remains to be seen.

From an innovator's perspective, expected revenues must exceed R&D costs in order to incentivize the development of new technologies. If consumer use of these technologies does not constitute a fair use, then innovators are forced to share revenues with copyright owners and social valuable technologies may not be produced at their optimum level (or at all). Moore thus proposes another rationale for fair use: it maintains "incentives to invest in new technologies that create new markets for copyrighted works" [41]. Using a differences-in-differences approach, Lerner shows that decisions regarding the scope of copyright protection can have significant impacts on investment and innovation in technology markets [42].

This argument is echoed by Von Lohmann, who suggests that, by insulating private copying from infringement liability, fair use attracts investment to copying technologies that are highly complementary to copyrighted works [28]. Fair use acts "as part of the 'start-up capital' on which innovators draw to breathe life into their fledgling technologies..." On this view, the fair use doctrine has been an unsung hero in the tale of America's innovation economy, encouraging investment and creating new markets for technology companies [28]. These markets create value for multiple parties. Fair use thus theoretically adds value by indirectly increasing the value of existing investments in copyrighted works for consumers; enhancing the appeal of new copyrighted works to consumers and consequently adding value for copyright owners; enabling revenue streams for copying technology manufacturers; and finally stimulating public access to technologies. Academic work on fair use has largely focused on the *transformative* use class. However, as Von Lohmann remarks, "if private, non-transformative copying is part of a mechanism that encourages innovation that ultimately improves the lot of copyright owners... this 'second-class status' for non-transformative copying must finally be cast aside" [28].

By establishing some forms of private copying as beyond the scope of copyright, fair use encourages investment in technologies that “grow the pie” for copyright owners, technology manufacturers and consumers alike [28,43]. The fair use doctrine is the primary defense for non-transformative, private copying of content by consumers. As such, it is likely to play an important role in stimulating growth in private copying technology markets and, by extension, markets for copyrighted goods.

### *2.5. Historical Context of Singapore’s Exceptions and Limitations for Copyright*

The evolution of Singapore’s Copyright Act is strongly intertwined with geopolitical changes at the international level. Singapore, a former British colony and Member of the Commonwealth of Nations, has established itself as one of Asia’s top economic performers over the last fifty years. It has become a member of the World Trade Organization, signed a series of Free Trade Agreements and seeks to assume its global role primarily through innovation leadership.

A forward looking national IP strategy plays a major role for the city state. At the same time, sceptics assert that the country still finds it difficult to embrace certain notions of democracy, such as freedom of expression. These big policy themes help understand the evolution of Singaporean copyright law and its approach to fair dealings.

The Imperial Copyright Act of 1911 was enacted in the UK and Singapore at the same time. Singapore’s copyright law was originally identical to that of the UK. Singaporean law reflects an Anglo-Saxon common law tradition and has moved from a very restrictive approach to limitations and exceptions to copyright law to a much more flexible system in 2005 based on the five-factor test [44].

Under the 1911 Imperial Copyright Act limitations and exceptions to copyright law were narrowly defined; essentially protecting fair dealings only for private study or research. There was no scope for copying for the purpose of facilitating a third party’s research needs. In 1987, the Copyright Act received major revisions to make it more able to adapt to emerging technologies that did not exist in the early 20th century. Fair dealing was limited to very specific purposes: (a) private study or research; (b) criticism or review; and (c) reporting current events or news. A parody for the sake of humor or self-expression was not covered. The taping of broadcasting programs for the purpose of time-shifting was also not covered by its fair dealing approaches [45].

Even after 1987 the Singaporean courts maintained a restrictive definition of research, which was only expanded to include “for profit” research when Singapore became a signatory of the TRIPS Agreement. However, it was not until Singapore signed a Free Trade Agreement with the USA (USSFTA) that this rigid and restrictive fair dealing rationale and practice was relaxed. Unsurprisingly, this new approach echoed US laws. The USSFTA triggered a range of measures that strongly reinforced copyright law. For example, the length of copyright protection was extended from 50 to 70 years and copyright infringement became a criminal offence, sanctioned with imprisonment and hefty monetary fines. However, Singapore simultaneously implemented more flexible copyright exceptions that sought to balance the needs of users and copyright holders. In 2005 the Copyright Amendment Act came into force and expanded the protection afforded to copying for research purposes. Most importantly, Singapore adopted an open ended approach to exceptions and limitations to copyright [46,47].



2.6. Fair Dealing Introductions to the Singapore Copyright Act

For the purposes of this study, the most important amendment of the Singapore Copyright Act is clause III.35. Fair dealing in relation to works. This fair dealing clause in Singapore strongly echoes §107. Limitations on exclusive rights: fair use of the Copyright Law of the USA. All uses of copyrighted work except for those protected under fair dealing clauses Section 36 and 37 of the Singapore Copyright Act define uses for the purpose of criticism or review and for reporting current event. The clause outlines a five factor the various factors courts must consider when making a retroactive judgment about fair use. This includes the purpose and character of the use, the nature of the work, the amount copied, and, perhaps most significantly, the effect of the use on the potential market for the work as well as the possibility of obtaining the work within a reasonable time at an ordinary commercial price [48]. The fair use factors in the Copyright Law of the USA are very similar except that there are only four factors considered in the fair use decisions. The additional factor (e) as described in Table 1 Section Singapore Copyright Act (see Table 1 below) present in the Singapore Copyright Act states that what constitutes a fair use is partly determined by the “possibility of obtaining the work or adaptation within reasonable time at an ordinary commercial price.” The flexibility embedded in the language is evident in terms such as “reasonable” or “ordinary”, which are not defined by statute. Which of the factors will be most decisive for determining fair use in a Singaporean context remains yet to be seen as there is a paucity of relevant Singaporean case law in this area. D’Agostino argues that very likely, Singaporean courts will be cautious to consider U.S. fair use cases that cause much disorder [40].

**Table 1.** Comparison of language in Singapore and USA Copyright Acts—factors for determining fair use.

Singapore Copyright Act	Copyright Law of USA
<p><b>Clause:</b> III.35. Fair dealing in relation to works (2)</p> <p><b>Text:</b></p> <p>For the purposes of this Act, the matters to which regard shall be had, in determining whether a dealing with a literary, dramatic, musical or artistic work or with an adaptation of a literary, dramatic or musical work, being a dealing by way of copying the whole or a part of the work or adaptation, constitutes a fair dealing with the work or adaptation for any purpose other than a purpose referred to in section 36 or 37 shall include:</p> <ul style="list-style-type: none"> <li>a. The purpose and character of the dealing, including whether such dealing is of a commercial nature or is for non-profit educational purposes;</li> <li>b. The nature of the work or adaptation;</li> <li>c. The amount and substantiality of the part copied taken in relation to the whole work or adaptation;</li> <li>d. The effect of the dealing upon the potential market for, or value of, the work or adaptation; and</li> <li>e. The possibility of obtaining the work or adaptation within a reasonable time at an ordinary commercial price.</li> </ul>	<p><b>Clause:</b> §107. Limitations on exclusive rights: fair use</p> <p><b>Text:</b></p> <p>Notwithstanding the provisions of sections 106 and 106A, the fair use of a copyrighted work, including such use by reproduction in copies or phonorecords or by any other means specified by that section, for purposes such as criticism, comment, news reporting, teaching (including multiple copies for classroom use), scholarship, or research, is not an infringement of copyright. In determining whether the use made of a work in any particular case is a fair use the factors to be considered shall include:</p> <ol style="list-style-type: none"> <li>1. The purpose and character of the use, including whether such use is of a commercial nature or is for nonprofit educational purposes;</li> <li>2. The nature of the copyrighted work;</li> <li>3. The amount and substantiality of the portion used in relation to the copyrighted work as a whole; and</li> <li>4. The effect of the use upon the potential market for or value of the copyrighted work. The fact that a work is unpublished shall not itself bar a finding of fair use if such finding is made upon consideration of all the above factors.</li> </ol>

The erosion of fair use as a result of a growing clearance culture can tilt the balance between control and access to copyrighted works in favor of copyright holders. Informed by the market failure theory of fair use decisions, the Singapore Copyright Act has ratified this in law. While this seems innocuous at first it has one important implication. It assumes that a use is not fair if there is the possibility of obtaining a license. This is problematic because licensing markets may encroach on the territory typically protected by fair use clauses over time. However, regardless of the potential impact of this last clause on the scope of fair uses in the longer term, the flexibility enshrined in fair dealing by this amendment is hypothesized to have a positive effect on the market for private copying as well as copyright technologies.

### 3. Methodology

We are assessing the economic impact of fair use changes to copyright law on the private copying and copyright industries in Singapore. This requires two separate tests. First, we test to see whether private copying industries experienced a significantly larger increase in growth rates relative to a representative sample of other industries (the control group) in the economy after the fair use amendments to Singapore's Copyright Act in 2005. Then we test if copyright industries also experienced a significantly larger increase in growth rates relative to the control group after the intervention date. If they have, then we can say that the change in law is correlated<sup>2</sup> to the increase in growth rate in the beneficiary groups. This is based on the assumption that copyright industries and private copying industries are direct beneficiaries of more flexible fair use policy and that the industries in the control group are not. Though the control group of industries may not be entirely insulated from the influence of fair use, they will be affected indirectly and to a much more limited extent, if at all. For the purposes of this study we assume that this influence is indirect and negligible, enabling us to have a control group that is subject to the same underlying macroeconomic trends as the treatment group but that is not influenced by the policy intervention of interest.

#### 3.1. Why Difference in Difference Analysis?

The suitability of applying difference in difference (DiD) methods, a counterfactual impact analysis, rests on several factors. First, the outcome must be replicable over time in order to make meaningful comparison of before and after the policy intervention. This means that equivalent measurements are reliably taken repeatedly for both pre- and post-treatment time periods. This is satisfied in our model because our dependent variable is value added, which is regularly collected in official panel data according to industrial classification codes in Singapore. Second, the intervention must be of a discrete (binary) nature, in the sense that certain units are exposed to the policy and others are not (the control group). While fair use policy may have a very minor, indirect influence in the industries selected for our control group, we assume this impact is negligible compared to the treatment groups.

Lack of pre-intervention data is often a limitation of DiD because data on a particular indicator may not be collected regularly prior to the policy intervention. This is typically labeled the *parallelism*

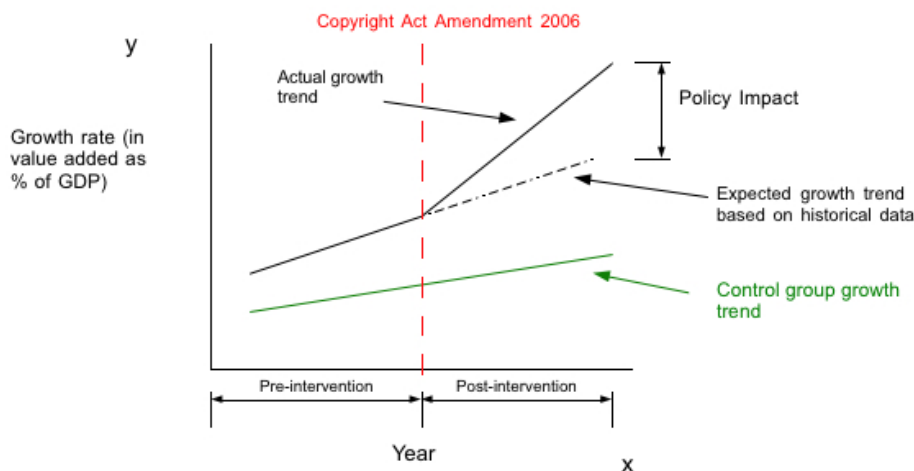
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<sup>2</sup> Note: correlation is not causality!

*assumption*. In our case, we can directly test the assumption that growth trends are the same for the treatment and control groups due to the availability of historical data for our dependent variable. If treatment and control groups do not have identical historical growth trends, we estimate the impact of the treatment by comparing average growth rates across groups before and after the date. We caution that this method cannot be used to attribute a causal relationship, DiD can only establish correlation between a policy and a given outcome.

We expect a larger growth rate after intervention in both private copying and copyright industry groups that are direct beneficiaries of fair use amendments as opposed to non-beneficiary groups where fair use is assumed to have a negligible impact. By identifying historic growth trends in these industry groups prior to the intervention date, we can predict their growth rate in the absence of the policy intervention. This prediction can then be compared against the existing data in the post-treatment period to provide a counterfactual impact estimate of fair use policy in Singapore. An alternative explanation of how DiD measures policy impact is that we begin with changes observed over time among beneficiary groups. In order to account for the natural dynamics of the economy that may be responsible for the observed change, we compute the change over time observed among non-beneficiaries as well. By subtracting the change observed among non-beneficiaries from that observed in the beneficiary group we produce an estimate of the policy impact. This is shown in Figure 1 below.

**Figure 1.** Illustrative example of counterfactual impact graph.



### 3.2. Model Elements

#### 3.2.1. Definition of Units of Observation (Treatment and Control Groups)

The definition of treatment and control groups attempts to replicate experimental trials in which all variables except for the dependent variable of interest are assumed to be the same. While this is impossible for the purposes of policy analysis, we can relax the assumption and assume that unobserved differences between the treatment and control groups are the same over time. This is why we integrate pre-treatment data in order to estimate the *typical* difference between the groups and compare this with the difference observed after the policy intervention. Historical data is plotted over time and the Ordinary Least Squares (OLS) method is used to estimate the coefficients of the linear regression model.

The approach also allows us to make projections about industry group growth rates based on historical data. Pre-treatment data for each industry group is used to make projections about growth rates. These projections are shown in the graphs as a dotted blue-line. This gives a rough estimate of the potential impact of fair use amendments on each group. A third trend line including all data points for each group is marked on the graphs in order to depict the general growth trends. This trend line used depends on an analysis of best fit to the data points (determined by the  $r^2$  coefficient of determination). While the actual impact of the fair use policy is certainly more complex than the graphs in the empirical part of this study portray, this complexity is integrated into the final estimates by adjusting for control group growth and testing the assumption of parallel growth between treatment and control groups.

We expect the introduction of flexible fair use policy to impact the growth of several industries that are aggregated here into two major groups: (1) private copying technology manufacturers and services (hereafter private copying group); (2) wholesalers, retailers and publishers of copyrighted works (hereafter copyright group). These two treatment groups are aggregated using the Singapore Standard Industrial Classification codes. The Annex contains the detailed splitting of the groups reflected in this study. Private copying technology industries are those industries that manufacture and sell technologies—and related electronic components, infrastructure, and services—that enable consumers to record, store, and transmit copyrighted material for their own personal use. Copyright industries are those industries whose primary sources of revenue are the reproduction, distribution, publication and sale of copyrighted materials, including film, audio and text.

In order to control for other macroeconomic factors that may impact growth trends in these industries, such as financial shocks, trade, other legislative changes and general investment climate, we include a comparable sample of industries in a third group: the control group. These are non-beneficiaries of the fair use policy intervention. The control group excludes any industrial classifications included in the treatment groups to ensure that the control and treatment groups are mutually exclusive. However, the industries selected for the control group are as similar as possible to the treatment groups in all respects except for the influence of fair use policy changes. The control group thus includes technology-related manufacturing and consumer electronics industries for which underlying macroeconomic trends are assumed to be similar to the treatment group. The industries selected are also limited by the data available from regularly collected, official sources. The final list of industries included in the analysis was refined according to available statistical data from the Singapore Department of Statistics and the Economic Development Board of Singapore. The following tables identify the industries included in each group: private copying, copyright, and the control.

It is important to recognize that the choice of industries included in the three groups was constrained by the availability of data and the relationship of the industry to private copying technologies or copyright. The private copying technology group includes all industries that manufacture or sell products that enable consumers to copy copyrighted content. In this sense, the growth of these industries is believed to be heavily reliant on fair use policy. Unfortunately, some industries included in the group are not directly related to private copying. This is the case, for example, with “Manufacture of Printers” or the “Manufacture of television sets and sub-assemblies”. This was a limitation imposed by the availability of data. In order to include “Manufacture of audio and video combination equipment” and “Manufacture of disk drives” in the private copying

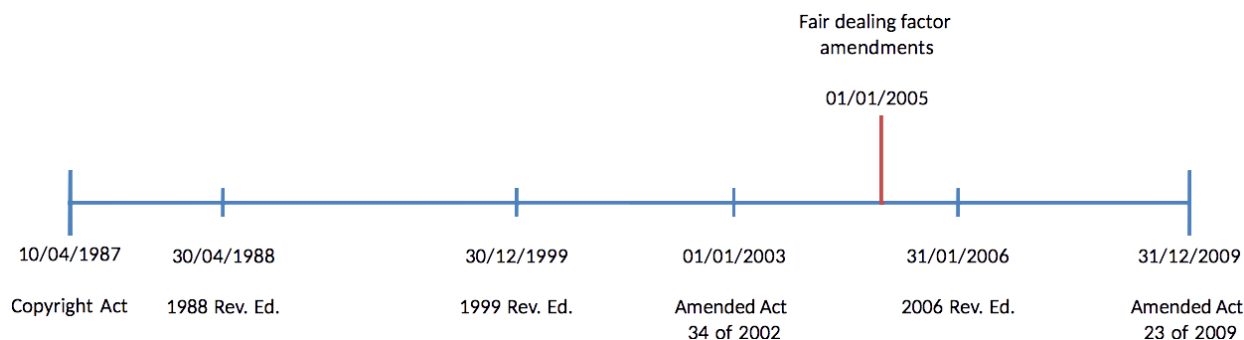
technology dataset, these other groups had to be included as well. While it imposes limits on the conclusions that can be drawn from the data, the model remains valid and helps to uncover the general growth trends across all three groups. A case could even be made for the inclusion of “manufacture of printers” in the private copying group because most modern printers now include scanners and photocopiers, which both enable the copying of copyrighted content by consumers to some extent.

### 3.2.2. Definition of Dependent Variable and Time Dimensions

A major determinant in the selection of the dependent variable is the availability of time-series data. We followed the Department of Statistics Singapore’s categorization, which provides the following statistics at a disaggregated industry level: (a) No. of Establishments; (b) Employment; (c) Value added; and (d) Remuneration.

The critical date for fair use policy amendments in Singapore is the date of ratification of the flexible fair use factor test on 1 January 2005. It is in this version of the Copyright Act that more flexible language relating to fair dealing in copyright was introduced. The modifications of the Singapore Copyright Act were part of a set of modifications of its IP laws in general, which resulted from its Free Trade Agreement with the United States. However, a review of the Singapore’s patent and trademark laws in the same year, does not suggest changes that would have been as significant for the industry groups studied here as the introduction of fair use under copyright law. Figure 2 below outlines the major introductions to the Singapore Copyright Act that influence the scope of fair use.

**Figure 2.** Timeline of major amendments to the Copyright Act in Singapore.



In order to test the assumption of identical growth trends between treatment and control groups in the absence of intervention (the *parallelism assumption*), we include historical data for the time period before the intervention. Time periods defined for DiD tests do not need to be the same length of time but must be clearly before and after the intervention date. The following time periods are used in this analysis to compare industry growth rates between the groups:

*Pre-intervention period = 1999–2004*

*Intervention date: 01/01/2005*

*Post-intervention period = 2005–2010*

## 4. Singapore: Counterfactual Impact Analysis

We caution that statistical analysis can never capture the full spectrum of socioeconomic behavior. Nor can a correlation serve as a baseline for making statements on cause and effects. All that the

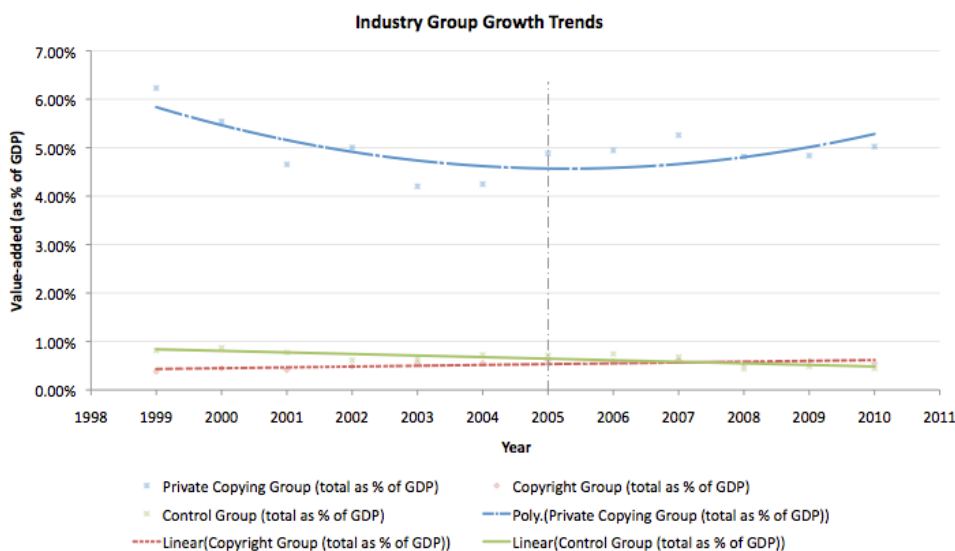
limited statistical assessments can do is offer an insight on potential dynamics between policy and economic performance. Against this background our preliminary results suggest fair use policy was correlated with the growth of the private copying group in Singapore. Five years after the policy intervention, in 2010, the counterfactual impact of fair use amendments is shown to be correlated with a 3.33% increase in value-added (as % of GDP) for the private copying group (see Table 2). Importantly, the control group was not significantly affected by the policy intervention. The counterfactual impact of fair use policies on the control group, five years after the intervention, is shown to be correlated with a 0.01% increase in value-added (as % of GDP). This is obviously a very short time frame and more data points would be needed to check to what extent these preliminary findings hold against a larger sample of countries. However, in spite of these limitations, the findings of a correlation between growth and change in the law cannot be ignored.

**Table 2.** Adjustment of Counterfactual Impact to Account for Control Group Growth.

	2010 Actual	2010 Predicted	Impact	Impact (adjusted for control)
Private Copying Group	5.02%	1.68%	3.34%	3.33%
Copyright Group	0.55%	0.78%	−0.23%	−0.25%
Control Group	0.44%	0.43%	0.01%	X

This is a strong indication that the control group is isolated from the treatment: the control group was not significantly affected by the fair use policy intervention and thus we can use values for this group to deduce the actual impact on the other industrial groups. This relaxes the assumption of parallel growth between all groups and thus reinforces the findings. The control group experienced a slight fluctuation in growth rates throughout both pre- and post-intervention time periods. However, it shrunk at a relatively constant rate in relation to the whole economy (see Figure 3).

**Figure 3.** Comparison of Industry Group Growth Trends Relative to Singapore Economy (value-added as % of GDP).



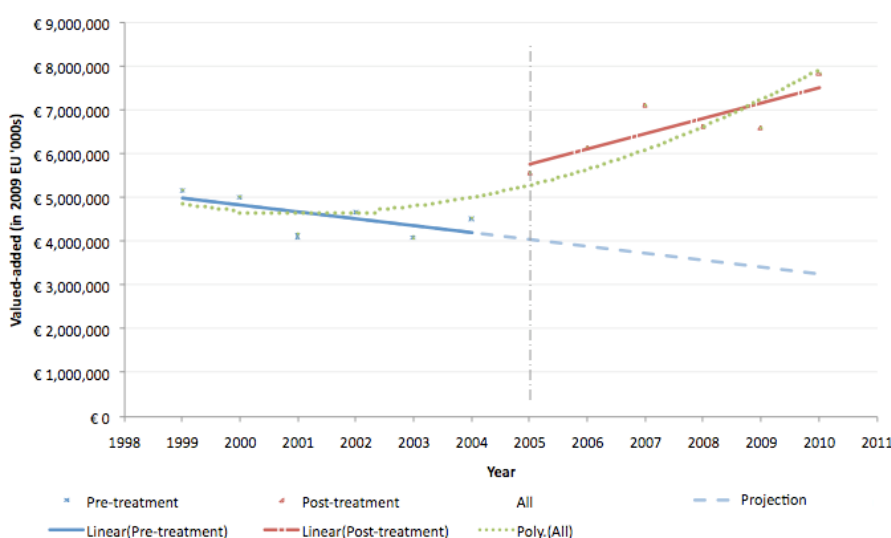
At the same date the copyright group dropped by a 0.23% drop in value-added (as % of GDP). While this suggests the growth of private copying industries is correlated with some negative impact

on the copyright industry group, the effect is relatively small in comparison to the positive correlations observed in the private copying technology industries.

4.1. Evaluating Growth Trends and Impact

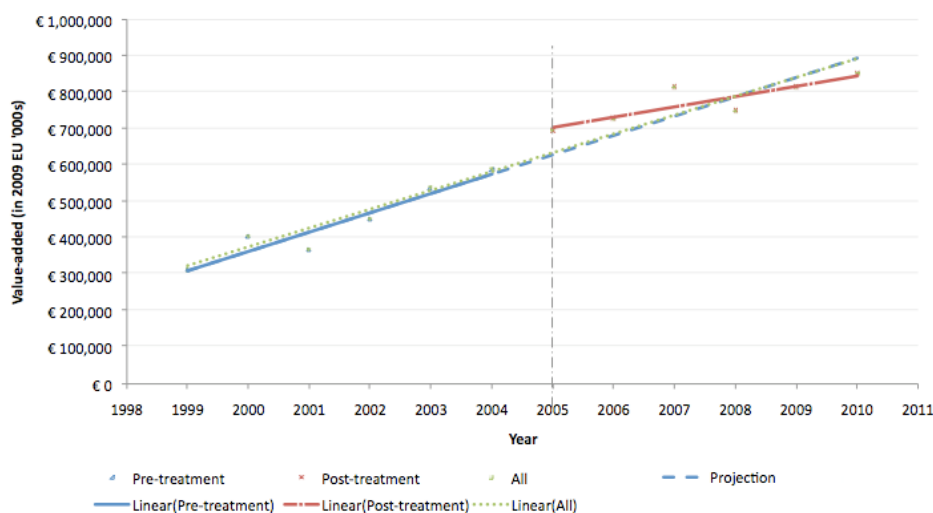
We now observe the differences in the growth trends and the differences in the values predicted by the pre-treatment growth model compared to actual values post-treatment. The private copying group (see: Figures 3 and 4) experienced negative growth prior to the intervention period and positive growth after the intervention.

**Figure 4.** Counterfactual Impact of 2005 Fair Use Amendment on the Private Copying Technology Group in Singapore (in 2009 EU ‘000s).



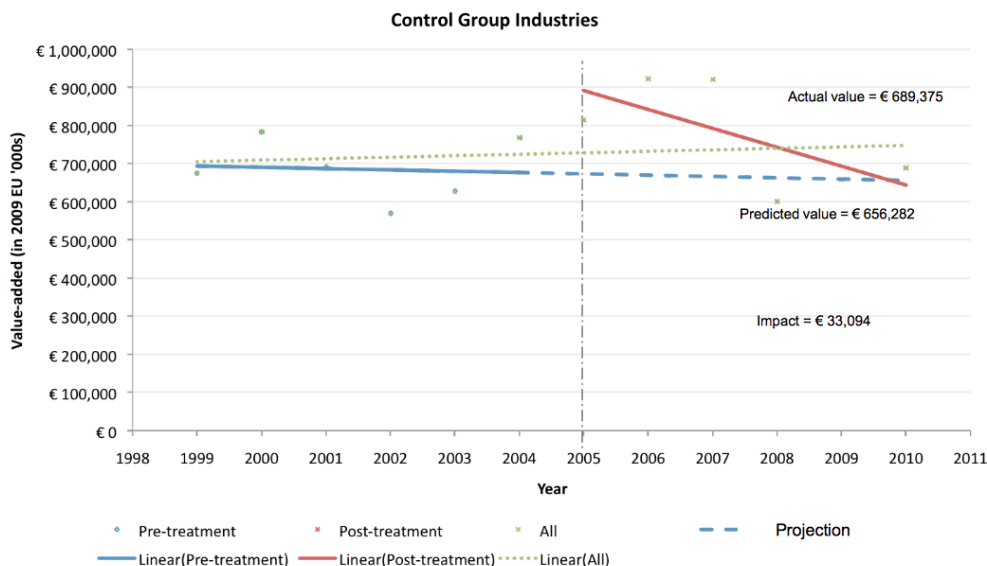
Copyright industries (see: Figures 3 and 5) grew at a constant, but small, rate over the entire period. There was no significant change in growth rates for the copyright group in the pre- and post-intervention time-periods in terms of real economic growth (value added as % of GDP).

**Figure 5.** Counterfactual Impact of 2005 Fair Use Amendment on the Copyright Group in Singapore (in 2009 EU ‘000s).



The control group experienced steady, albeit small, recession during both pre- and post-intervention time periods (see: Figures 3 and 6).

**Figure 6.** Counterfactual Impact of 2005 Fair Use Amendment on the Control Group in Singapore (in 2009 EU ‘000s).



This suggests that the introduction of fair use policies had no impact on the control group, which continued to experience the same growth trend both before and after 2005. The year-on-year growth rates of the control group fluctuated significantly but period-averages were closer in magnitude than the other two groups (3.89% pre-treatment growth and -0.22% post-treatment growth). The control group did not experience the same linear growth trends as the other two groups. This emphasizes the need to relax the assumption of parallel growth in our model by subtracting typical differences in non-beneficiary groups from beneficiaries.

This said, assuming parallel growth rates between beneficiaries and non-beneficiaries provides a general understanding of industry trends for our groups in Singapore before isolating the impact of fair use policy. It also enables the comparison of actual value-added data for 2010 against values predicted by the pre-treatment OLS regression model (see Table 3).

**Table 3.** Actual and predicted values of counterfactual Impact of 2005 Fair Use Amendment on the Control Group in Singapore (in 2009 EU ‘000s).

	2010 Actual	2010 Predicted	Impact	Percentage difference
<b>Control Group</b>	€ 689,375	€ 656,282	€ 33,094	4.80%

Table 4 depicts the total change in industry group value-added for both pre- and post-treatment time periods. This gives a basic picture of the growth in these industry groups both before and after the intervention. These results are supported by the changes depicted in Figures 3–6. In general, the results show that private copying technology industries were in recession prior to 2005 with -1.97% average annual growth and a total reduction of over € 651 million in value-added). After 2005, these industries



enjoyed considerable growth (10.18% average annual growth in post-treatment period; a total increase of € 2.27 billion) (see Tables 4 and 5).

**Table 4.** Actual and predicted values of counterfactual Impact of 2005 Fair Use Amendment on the Copyright Group in Singapore (in 2009 EU ‘000s).

	2010 ACTUAL	2010 PREDICTED	IMPACT	PERCENTAGE DIFFERENCE
<b>Copyright Group</b>	€ 852,437	€ 894,134	−€41,696	−4.89%

**Table 5.** Total Change in Industry Group Value-added for Both Time Periods (in 2009 EU ‘000).

	Pre-treatment change (1999–2004)	Post-treatment change (2005–2010)
<b>Private Copying Group</b>	−651,804	2,273,191
<b>Copyright Group</b>	274,096	158,184
<b>Control Group</b>	93,937	−124,871

The copyright group enjoyed an average growth rate of 14.16% prior to 2005 (a total increase of over € 274 million in value-added). This slowed to 6.68% after 2005 and resulted in a total post-treatment increase of over € 158 million in value-added. While growth certainly slowed down in absolute terms, the industry group nevertheless continued to grow after the intervention. Moreover, the magnitude of the change was minimal in comparison to the private copying group. The implications for the copyright group were even more negligible when one considers the size of the group relative to the whole economy. This estimate is rough because it does not account for the changes observed among non-beneficiary groups, nor does it factor out trade aspects. The actual values and those predicted by the model are almost identical. This shows that control group growth relative to the entire economy was unaffected by the policy intervention.

#### 4.2. Testing the Parallelism Assumption

Analysis of growth rates shows that the parallelism assumption does not hold. In fact, the private copying group was shrinking at a faster rate before 2005 than the control group. After the amendments, the private copying group experienced a much stronger rise in growth rates than the control group.

The assumption of parallel growth did not hold: the industry groups did not experience the same growth rates prior to the intervention.

Private copying: −1.97% growth

Copyright: 14.16% growth

Control: 3.89% growth

Particularly interesting is that the parallelism assumption has actually resulted in more conservative estimates of the impact. This is because private copying industries were in decline before 2005 (−1.97%) while the control was growing (3.89%). After 2005, private copying groups exhibited high growth (10.18% on average) while the control dropped to a negative growth rate of −0.22%. It is worth noting that the drop in growth rates in the copyright and control groups post-treatment may be a shock induced by the global financial crisis; while the private copying group also experienced a recession in 2008 (−6.82% compared to −7.97% (copyright) and 34.77% (control)), this was much less devastating

than the control and the private copying group quickly bounced back to 19.23% growth in 2010 (compared with 4.57% for the control in 2010).

Accounting for typical differences in growth rates (*i.e.*, the control), we observe the following impact of fair use policy on average growth in private copying and copyright industries:

Private copying group: 16.26%
Pre-treatment: −5.86%
Post-treatment: 10.41%
Copyright group: −3.37%
Pre-treatment: 10.28%
Post-treatment: 6.91%

Though the copyright industry growth rate seems to have been negatively affected after 2005 when observing the unadjusted period averages (see Figure 4), adjusting for the growth rate of the control shows the real difference to be relatively minor (treatment impact on copyright growth: −3.37%). While one might expect a rise in private copying technology industries to result in a significant recession for the copyright industries, this has not been the case in Singapore.

#### 4.3. Limitations

There are a number of limitations to the conclusions that can be drawn from these results. First, it is important to note two industrial groups<sup>3</sup> were excluded from the control group in the final analysis because these proved to be major outliers that witnessed a drastic increase in value-added in 2004 and 2005. The two industrial groups were not analytically distinct from the private copying technology group and thus could not qualify for the control group, which must be isolated from the treatment groups. The market for networking products and wireless communications equipment is very closely associated with private copying technologies such as personal computers. The same can be said for the wholesale of electronic components, wearable computers and palmtops. Growth in private copying markets may stimulate, either directly or indirectly, growth in these industries, regardless of a change in fair use policy or not. Consequently, these outliers were removed in order to keep the treatment and control groups analytically distinct.

The difference in the relative size of the industrial groups—the private copying group is much larger than the copyright group and the control group—means that direct comparison of Figures 3–5 is misleading. The relative sizes of each group is more apparent in Figure 6; which shows year-on-year growth trends of each group (in value-added as % of GDP). These limitations of raw value-added data are why the final counterfactual impact; adjusted for typical differences against the control; is supplemented by data expressed in value-added as % of GDP. The relative sizes of the groups were conditioned by two factors: (a) the need to include comparable industries in the control group as the private copying group (*i.e.*, high technology manufacturing/service industries) that would not be directly affected by fair use amendments; (b) the industrial statistics available for the given period in

<sup>3</sup> The two industrial groups removed: (1) 26302/26303—Manufacture of networking products (e.g., routers, switches)/Manufacture of wireless communications equipment (e.g., cellular phones); (2) 46522/46523—Wholesale of electronic components/Wholesale of pagers, handphones, and other telecommunications apparatus (e.g., palmtops, smart watches, wearable computer and electronic books).

Singapore. For example; the copyright group does not include copyright industries such as software publishing; because there was no available data for these SSIC groups. The smaller size of the copyright and control groups means that the aggregated group data is more susceptible to fluctuations in a single industry. This is most obvious in Figure 5; where the data points for each year do not follow a strict linear trend. This limitation is imposed by the lack of available data in Singapore for certain copyright industries and for control industries sufficiently similar to the private copying technology group. While this limits the conclusions that can be drawn from at a glance comparison of the counterfactual impact graphs; the detailed results remain valid.

A related limitation is the low  $r^2$  value for the OLS regression of the control group in the pre-treatment period. While this suggests that the model may not predict future values as accurately for the control group, we have assumed the trend to be linear in order to conduct the counterfactual impact analysis across all groups. This assumption is not unwarranted, given the small change in actual value-added that these fluctuations represent for the control group. The  $r^2$  values for the three groups are provided below (see Table 6)

**Table 6.**  $R^2$  values for OLS regressions in all industry groups.

	Pre-treatment regression	Post-treatment regression
Private Copying Group	0.4567	0.69475
Copyright Group	0.91184	0.75258
Control Group	0.00624	0.45037

Like any quantitative analysis, this case study would benefit from more data for the selected industries in Singapore. A larger time-series should result in higher values for the coefficient of determination (*i.e.*, a more accurate model for predicting future values) as well as enable us to test the parallelism assumption more accurately. Unfortunately, the data constraints imposed by the case study made this impossible. No data at four and five digit SSIC codes was available for Singapore before 1999 for the selected industries or after 2010. Despite this limitation, we were still able to test the assumption of parallel growth.

While the control group growth was different from the other groups both before and after the policy intervention, this does not undermine the findings of the study. The assumption of parallel growth rates between treatment and control groups is only necessary if the growth trends prior to the policy intervention cannot be calculated. Since sufficient data was available for the years prior to the fair use intervention, these growth rates can be calculated and the differences integrated into the impact model. Given that the data was not available at a highly disaggregated level in Singapore and that we are interested primarily in overarching growth trend of each group, we believe that the model provides insights on the dynamics of copyright law and growth. Again, this statement must be qualified by recognizing the complexity of economic systems and the difficulty of isolating the impact of a single policy.

Another limitation is that this paper does not *explicitly* analyse trade. The paper does take trade into account as part of the larger economy as the domestic sale of imported foreign content is included and so is the sale of domestic content to foreigners. Fair Use, after all, affects both the domestic and international markets. Singapore's fair use legislation is quite similar to that of the U.S. and one would not expect a distinctive response from foreign rightsholders that would be different from domestic rightsholders. For example, it is doubtful that foreign content owners would uniquely withhold their

products from the Singapore market because of the added fair use provisions. These limitations impose some constraints on the conclusions that can be drawn from the data but the model remains valid in its circumstances.

## 5. Conclusions

As copyright becomes an increasingly important determinant of growth, it is vital to reflect on the legal architecture in which the exchange of information occurs. By vesting rightholders with exclusive rights to the distribution and sale of creative content, copyright law resolves market failures that result from the non-excludable and non-rivalrous nature of information products and services. Scientific and cultural progress benefits from copyright policy because it incentivizes the creation and distribution of new works. However, scientific and cultural progress also depends on adequate access to those works. There is thus an inevitable balance of interests in copyright between the users and owners of information products.

The delicate balance of incentive and access in copyright has in an Anglo Saxon tradition historically been maintained by the fair use doctrine, which protects certain uses—such as educational, archival or personal uses—against claims of infringement. Flexible fair use policy, such as those amendments recently introduced in Singapore to echo the Copyright Law of the USA, are a tool to promote access to information products and stimulate growth in private copying technology markets. The introduction of a five-factor test for fair use decisions in Singapore (in the Singapore Copyright Act III.35 Fair dealing in relation to works) is the most significant of these amendments.

As digital technologies usher in new opportunities to control consumption of copyrighted works with reduced transaction costs, a market failure analysis of fair use might suggest that fair use in copyright is no longer necessary. Regardless of the impact on freedom of speech and personal privacy, this argument obscures an important economic value proposition of fair use. This value proposition results from the fact that fair use encourages investment and innovation in private copying technologies, serving as start-up capital in a valuable high-technology industry. Indirectly, fair use may also stimulate demand for copyrighted works by promoting the diffusion of private copying technologies, which enable consumers to space- and time-shift copyrighted works in ways that increases their overall value. Fair use is the only defense for these increasingly common, non-transformative copying activities that fall under the *personal* fair use class.

The counterfactual impact analysis of copyright law amendments in Singapore seems to support our hypothesis that a more flexible fair use policy is correlated with faster growth rates in private copying technology industries. Our model shows that fair use policy is correlated with faster growth in the private copying technology industries in Singapore. The counterfactual impact analysis did however not support our second hypothesis that flexible fair use policy would be correlated with higher growth in the copyright industries (indirectly via the growth of private copying technology industries). Thus, while the growth of copyright industries slowed down to a limited extent after 2005 in Singapore, the industrial group did not experience the degree of negative impact one might expect when considering copyright industry rhetoric against personal copying by consumers. Moreover, this limited negative impact was more than offset by the positive impact of fair use policy correlated with higher growth in private copying technology industries. Our results suggest that flexible fair use policy is correlated with substantially higher growth rates in private copying technology industries while having only a

minor impact on copyright industries in Singapore. This economic value proposition stems from the fact that fair use acts as start-up capital in private copying technology industries, stimulating growth in an innovative high-technology sector.

We re-emphasize that our analysis *suggests* a correlation between these factors, but more research would be necessary to gain a more comprehensive understanding of the economic dynamics surrounding exceptions and limitations to copyright law. We view our paper not so much as a proof that fair use increases private copying technology markets, but as a starting point to usher in more research into the subject by highlighting that the relationship between copyright, fair use, and economic growth in technology and copyright industries is far more complicated than traditional copyright discourse suggests. A possible springboard into more research could be to isolate trade effects. Was there a statistical association between the policy change and changes in the amount of imports of copyright-intensive products, controlling for other factors? Did the introduction of fair use provisions have an effect on trade in copyright-content-intensive products? Very likely these effects were small, however further empirical research from a mere trade perspective could provide additional insights.

### Author Contributions

This research paper is a revised form of a study undertaken by Oxfirst Limited in 2012. When Oxfirst Limited undertook this study, Dr. Roya Ghafele was the Managing Director of the Firm and Benjamin Gibert was a research consultant. In their respective capacities, Dr. Roya Ghafele managed the study and Benjamin Gibert undertook the necessary background research for this study. In doing so, he was also assisted by another Oxfirst Limited Consultant, Timothy C. Krah, whose support for the study is hereby gratefully acknowledged. During the course of 2013/2014 Dr. Ghafele subsequently revised the study in the course of her engagement with Edinburgh University and turned it into an academic paper. During the subsequent peer review process Benjamin Gibert provided helpful comments.

### Annex

**Table A1.** Private copying technology industry group.

SSIC 2010	Industry
26201	Manufacture of computers and data processing equipment except computer peripheral equipment
26202	Manufacture of disk drives (including CD-ROM drives, DVD-ROM drives, optical drives, flash drives, tape drives, solid state drives)
/26203	Manufacture of storage subsystems
/20204	Manufacture of printers
/26205	Manufacture of smart cards and related products (e.g., smart card readers)
/26209	Manufacture of computers and peripheral equipment nec
26401	Manufacture of television sets and sub-assemblies (including television chassis)—included due to grouping *
/26402	Manufacture of microphones, loudspeakers and amplifiers—included due to grouping *
/26403	Manufacture of audio and video combination equipment (e.g., radios, television sets, record players and tape recorders/players combined with each other and with clocks, VCD and DVD recorders/players)
/26409	Manufacture of consumer audio and video equipment
18200	Reproduction of recorded media (including reproduction of phonograph records, recorded magnetic tapes, compact discs and non-customized software)

**Table A1. Cont.**

SSIC 2010	Industry
/26801	Manufacture of disk media
/26802	Manufacture of blank magnetic tapes, diskettes, Bluray technology discs, CDs, DVDs and VCDs
46436	Wholesale of audio and video equipment except electrical and electronic components (e.g., radio and television sets, sound reproducing and recording equipment)
4651	Wholesale of Computers, Computer Peripheral Equipment and Software
4741	Retail Sale of Computers, Peripheral Units, Software and Telecommunications Equipment in Specialised Stores
4742	Retail sale of audio and video equipment in specialized stores

Note: \* Included for data aggregation purposes (data was only available when aggregated into these four industry groups).

**Table A2. Copyright industry group.**

SSIC 2010	Industry
46442	Wholesale of music and video recordings (e.g., record albums, compact discs, VCDs, DVDs)
46474	Wholesale of books and magazines
4761	Retail Sale of Books, Newspapers and Stationery in Specialised Stores
4762	Retail Sale of Music and Video Recordings in Specialised Stores
5811	Book Publishing
5813	Publishing of newspapers, journals and periodicals
5819	Other publishing activities
5911	Motion Picture, Video and Television Programme Production Activities
5913	Motion picture, video and television programme distribution activities
5919	Other motion picture, video and television related activities
60100	Radio programme production and broadcasting
/60200	Television programming and broadcasting (including cable, satellite, terrestrial television, internet and mobile)

**Table A3. Control group.**

SSIC 2010	Industry
26124	Manufacture of printed circuit boards with electronic parts (exclude contract manufacturers)
/26127	Manufacture of electronic display devices except light emitting diodes
26129	Manufacture of other electronic components and boards nec
26302	Manufacture of networking products (e.g., routers, switches)
/26303*	Manufacture of wireless communications equipment (e.g., cellular phones)
26701	Manufacture of photographic equipment and parts (including lenses)
/26709	Manufacture of optical instruments and photographic equipment nec
46522	Wholesale of electronic components
/46523*	Wholesale of pagers, handphones, and other telecommunications apparatus (e.g., palmtops, smart watches, wearable computer and electronic books)
46591	Wholesale of office machines and equipment (including accessories)
47752	Retail sale of cameras and other photographic goods
/47759	Retail sale of optical and photographic goods

Notes: \*Outlier removed—these industries are too close to the private copying group; growth in these sectors may be affected both directly and indirectly from growth in private copying technology industries. See limitations in discussion of results for further information.

**Table A4.** Singapore statistical regressions.

Variables	(1)	(2)	(3)	(4)
	Private Group Growth	Copyright Group Growth	Private Group Growth	Copyright Group Growth
Post-2004 (After Law)	0.133 * (0.0649)	−0.0625 (0.0667)	0.134 * (0.0664)	−0.0629 (0.0632)
Control Group Growth	−0.239 (0.384)	0.464 (0.394)	0.147 (0.213)	0.363 (0.203)
Interaction (Post-2004 * Control Group Growth)	0.546 (0.457)	−0.143 (0.469)		
Constant	−0.0419 (0.0493)	0.126 ** (0.0506)	−0.0388 (0.0504)	0.125 ** (0.0479)
Observations	12	12	12	12
R-squared	0.454	0.306	0.357	0.298

Notes: Standard errors in parentheses; \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .

**Table A5.** Data used in regression analysis.

Year	Private Group	Private Group Growth	Copyright Group	Copyright Group Growth	Control Group	Control Group Growth	Post-2004	Interaction
1999	5165802	0	314209	0	674260	0	0	0
2000	5008101	−0.03	402813	0.28	783667	0.16	0	0
2001	4159460	−0.17	366906	−0.09	691201	−0.12	0	0
2002	4657315	0.12	450331	0.23	569213	−0.18	0	0
2003	4091087	−0.12	537019	0.19	627441	0.1	0	0
2004	4513998	0.1	588305	0.1	768197	0.22	1	0.22
2005	5569224	0.23	694253	0.18	814246	0.06	1	0.06
2006	6134708	0.1	726192	0.05	922481	0.13	1	0.13
2007	7102333	0.16	812783	0.12	921191	0	1	0
2008	6618077	−0.07	747985	−0.08	600850	−0.35	1	−0.35
2009	6577661	−0.01	813671	0.09	659247	0.1	1	0.1
2010	7842415	0.19	852437	0.05	689375	0.05	1	0.05

## Conflicts of Interest

The authors declare no conflict of interest.

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