Research Policy 52 (2023) 104820

Contents lists available at ScienceDirect

Research Policy

journal homepage: www.elsevier.com/locate/respol

Batman forever? The role of trademarks for reuse in the US comics industry ☆

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ARTICLE INFO

JEL classification:
O31
O34
L82
Z11

Keywords:
Comics
Trademarks
Intellectual property rights
Digitization
Reuse

ABSTRACT

We study how trademarks affect reuse of creative works in the comics industry. As a creative industry, the comics industry systematically relies on copyrights. But trademark protection can also be exploited to generate income from the reuse of comic characters or to strategically exclude others from reuse. Our unique data set combines US trademark records of comic characters with information on reuse in print media and franchise products from 1990 to 2017. We find that, on average, additional trademark protection is associated with a reduction in reuse in printed comic books of about 19%. We highlight three mechanisms: first, the negative relationship between trademarking and reuse has been especially pronounced since the early 2000s, when the arrival of digital technologies lowered the costs of entry, promotion, and distribution. Second, our results are driven by less reuse by third parties, not trademark holders. Third, reuse is higher when trademark owners license comic characters to third parties. The negative association between trademarking and reuse carries over to franchise products, but it is weaker and tied to the era of digitization, with a 2% decline in reuse in franchise movies and 9% lower reuse in video games.

1. Introduction

As intellectual property rights (IPRs) become increasingly dominant, it becomes more urgent to understand their societal implications. For patents and copyright, this question has already been extensively studied (Chaudhuri et al., 2006; Nagaraj, 2018; Reimers, 2019; Watson et al., 2022). The societal implications of trademarks (TMs) have been much less investigated, despite TMs' widespread use and high practical relevance (Castaldi and Mendonça, 2022; Castaldi, 2023).

One context in which questions about the societal implications of TMs have emerged is the creative industries. In these industries, copyrights are in principle the main IPRs, but firms increasingly use TMs as well. The relevance of TMs grows toward the end of the creative process, when products or services are brought to market. Incumbent firms may strategically use TMs to secure market positions because, like other IPRs, TMs protect firms from imitation and competition. TMs also help owners to appropriate rents, either by exploiting exclusive rights or by participating in licensing markets, and to attract resources from investors (Castaldi, 2018, 2020; Castaldi et al., 2020; Fisch et al., 2022). What makes TMs special is that they signal value to consumers, which allows firms to differentiate their products and establish a competitive advantage (Ramello and Silva, 2006; Gao and Hitt, 2012). Hence, from a theoretical standpoint, TMs can limit or enhance reuse. This calls for an empirical investigation. So far, only a handful of studies have looked at the combination of TM and copyright protection; they have shown the existence of both private returns and societal costs (Heller, 2008; Calboli, 2014). However, their findings are based on legal research and case studies; systematic empirical evidence is missing.

We fill this research gap by focusing on the US comics industry. Comics as original expressions automatically fall under copyright law, but comic characters are also eligible for TMs (Calboli and Ginsburg,

☆ The views expressed are those of the authors and do not necessarily reflect the views of the World Intellectual Property Organization or its member states. Earlier versions of this paper circulated under the title "Batman Forever? The Economics of Overlapping Rights." We are grateful to the editors and two anonymous reviewers for their helpful comments. The authors thank Kyle Bergquist, Anastasiya Letnikava, and Nathan Sierro for excellent research assistance and Erdem Dogukan Yilmaz and Lambiek Studio for sharing their data. We also thank Jean-Phillipe Bonardi, Carolina Castaldi, Irene Calboli, Darlene Chisholm, Estelle Derclaye, Carsten Fink, Christian Helmers, Marcus Hoepperger, Guy Pessach, Matthias Sahli, Martin Senftleben, and seminar and conference participants at ACEI, Bournemouth University, CESifo Area Conference on Economics of Digitization, Digital Economy Workshop Norwich, ETH Zurich, EPIP, HEC Lausanne, International Industrial Organization Conference, RGS Doctoral Conference in Economics, Paris Digital Economics Conference, Summer School for Data & Algorithms, and WIPO for helpful comments on prior versions.

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[1] See, for example, the copyright and TM policy of DC Comics: https://www.dc.com/blog/2012/03/05/copyright

https://doi.org/10.1016/j.respol.2023.104820
Received 14 March 2022; Received in revised form 16 May 2023; Accepted 22 May 2023
Available online 12 June 2023

2020), making the comics industry a prime case to study the relationship between TMs and reuse in the context of overlapping IPRs.[1] We ask how trademarking and licensing decisions affect reuse by TM owners and third parties across media (print, movies, and video games). Our empirical approach builds on a similar idea to one in Boldrin and Levine (2008), Heald (2014), and Reimers (2019), where the authors show that books under copyright are less likely to be available than books not under copyright. We instead study the relationships between TMs and the likelihood that a comic character is reused in print comic books or other media, and the relationship between TMs and how often a comic character is reused in print comic books and other media. We also study situations in which reuse can be blocked or enabled by trademarking and the corresponding licensing decisions of the rights holder. Compared to prior research, which relies on identification strategies based on when IPR protection is introduced, prolonged, or removed (Boldrin and Levine, 2008; Heald, 2014; Nagaraj, 2018; Reimers, 2019), we provide evidence on which effect prevails: whether TMs exclude third-party reuse or whether TMs enable licensed third-party reuse. Further, we exploit changes in the market environment due to technological advancement made possible by digitization, and we study how this advancement has altered the relationship between TMs and reuse.

We build a unique data set that lets us follow 49,369 comic characters' US TM protection status and their reuse in print comic books, franchise movies, and video games from 1990 to 2017. We compare reuse of trademarked characters to reuse of characters that are not yet protected by TMs. While we do not claim to show causality, we do employ recent methods to arrive at potentially unbiased estimates (Goodman-Bacon, 2021; Callaway and Sant'Anna, 2021). Our results suggest that the supply-limiting effects of TMs outweigh the supply-enhancing effects. We find that, on average, TMs are associated with about 19% less reuse of comic characters in comic books. The long time dimension of our data allows us to study how changes in the market environment due to digitization have altered the relationship between TMs and reuse. We show that the negative relationship has become more pronounced since the early 2000s—the era of digitization, which has been characterized by lower production, promotion, and distribution costs in the comics industry (Hardy, 2019). The net reduction observed in the data is mostly driven by a reduction in third-party reuse, while reuse is higher when trademarked characters are licensed. Finally, we show that TMs are also associated with less reuse in franchise movies (−2%) and video games (−9%) in the era of digitization.

Our study contributes to different strands of literature. First, we contribute to the field's understanding of the societal returns to IPRs by focusing on TMs and their strategic use (Castaldi et al., 2020; Castaldi, 2023), especially in conjunction with other IPRs (Derclaye, 2017; Senftleben, 2021). We extend the literature by studying the role of TMs in the supply of new products built upon cumulative creative efforts. We complement the case-study work of legal scholars (Heller, 2008; Calboli, 2014) and contribute to the evidence base on TM licensing and reuse (Fosfuri et al., 2008). Second, we contribute to research on the economics of copyright. Specifically, our research complements work on copyright, reuse, and cumulative creativity in music (Gans, 2015; Watson, 2017a,b; Cuntz, 2022; Watson et al., 2022), book publishing (Heald, 2014; Reimers, 2019), visual arts (Cuntz and Sahli, 2023), and online platforms (Nagaraj, 2018). Third, we contribute to the broader literature on the effects of digitization on innovation and supply of creative products by highlighting the role of TMs in reuse and in follow-on innovation (Waldfogel, 2017; Aguiar and Waldfogel, 2018; Peukert and Reimers, 2022; Bradley and Kolev, 2023).

2. Background

2.1. The US comics industry

The US comics industry has generated revenues of more than a billion dollars in recent years (Hardy, 2019), but it dates back to the early 20th century. After the success of Disney's *Mickey Mouse*, which was first published in 1928, the Golden Age of Comic Books started, which saw the emergence of superheroes such as Superman and Batman in the late 1930s. Over the decades, the US comics industry has undergone significant changes that continue to shape it today. The 1990s was a pivotal time for the industry, as it saw the rise of new forms of storytelling and the emergence of new publishers (that is, publishers other than Marvel and DC Comics). The industry has seen several cases of vertical integration of comic publishers, movie and video game producers, and online distributors.[2] Some of these mergers have raised competition-policy concerns about future reuse of original characters by parties other than the rights holders (Saval, 2013). Between 2005 and 2017, 68% of total revenue was received by Marvel and DC Comics, showing that the US comic book market has become highly concentrated (Hionis and Ki, 2019).

Several waves of digital-technological change, starting in the 1990s and rapidly accelerating in the first decade of the 21st century, have transformed the comics industry. Technological advancements have lowered the fixed costs of production, distribution, and promotion in the comics industry (Hardy, 2019). Therefore, as in other industries – for example, books – digitization has allowed more entry and provided challenges to traditional gatekeepers (Waldfogel and Reimers, 2015; Reimers, 2016). In particular, the emergence of personal computers, graphics software, and pen-based input devices has made it considerably cheaper and easier to develop and produce comics.[3] And with the advent of copying machines, high-resolution color printers, and print-on-demand services, the physical-reproduction costs of comic books have fallen. The arrival of the internet and e-commerce platforms has opened new possibilities for distributing comic books nationwide or even internationally. Comics enthusiasts have scanned tens of thousands of physical comic books and made them available on unlicensed websites (Delwiche, 2014), while dedicated distribution platforms for digital comic books have entered the market (for example, ComiXology, which started in 2007 and was acquired by Amazon in 2014). Since the early 2000s, crowdfunding platforms have enabled creators to circumvent traditional sources of financing. Social media, as well as dedicated fan forums and review platforms such as Fandom and Comicbook Roundup, provides nontraditional promotion opportunities and lowers search costs for consumers. Similarly, online communities and review platforms have created information that both consumers and publishers can use to make better purchase and investment decisions (Reimers and Waldfogel, 2021; Peukert and Reimers, 2022). Finally, digitization and the internet have lowered search costs for potential licensees, enabled low-cost communication, and led to the emergence of platforms and services such as Surge Licensing and Heroic Signatures that accumulate IPRs of comic characters or act as marketplaces for IPR licenses.

Consistent with these changes and as in other entertainment industries (Waldfogel, 2017), supply has increased massively since the beginning of the 21st century in the comics industry. In the left panel of Fig. 1, we see that before digitization accelerated in the first decade of this century, the annual number of comic book releases fluctuated around 10,000 per year. The number then increased, reaching more than 23,000 prints per year in 2017. Comic characters are not limited to physical print media but also started to appear in franchise movies and video games as soon as these technologies became available (Hardy, 2019). Lower fixed costs of creating movies and video games, made possible by technological advances in digitization (Waldfogel, 2016), have further extended the size of the franchising market for comic characters. Many popular comic book franchises, such as DC's Batman and Superman franchises and Marvel's Cinematic Universe, have

[2] Prominent examples include the 2009 Walt Disney/Marvel merger and the parent-subsidiary ties established between Time Warner, DC Comics, and Warner Bros. Saval (2013).

[3] See https://www.nytimes.com/2019/11/13/arts/comic-books-computers-dc-marvel.html.

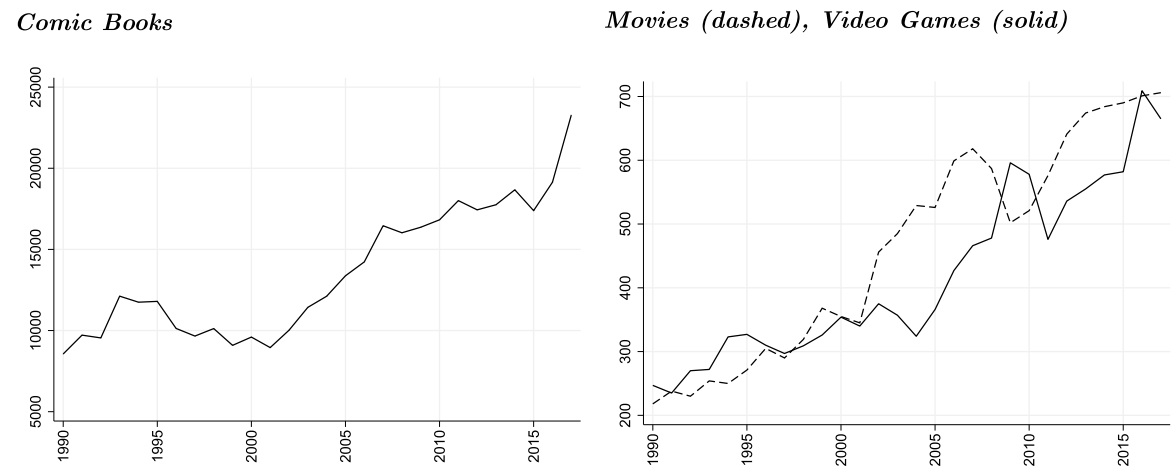

Fig. 1. Total number of comic books, movies and video games released in the US,1990–2017
Note: Own elaborations based on data from the Grand Comics Database (books), GiantBomb (video games), and Box Office Mojo (movies).

been adapted into successful movies and television shows. This often involves marketing across several media formats, which has helped to boost the popularity of comics and perhaps further increased the number of comic reuses, especially in the video game market. The right panel of Fig. 1 illustrates this development. Starting in the 1990s and accelerating in the next decade, the era of digitization has brought more than a twofold increase in the numbers of video games and theatrical movie releases.

2.2. IPRs in the US comics industry: copyrights and TMs

In the US, comics are classified as creative works, much like books, music, or movies. Since they are original expressions of ideas, they are automatically protected by copyright from the moment of creation or first publication and do not require formal registration. Comic books are usually collaborative projects that involve several contributors, such as writers, pencilers, and inkers. In general, copyrights aim to spur creativity by granting original creators a temporary period of protection and control over the commercial use and distribution of works.[4] Enforcement of copyright laws can also prevent unauthorized copying or reuse of creative works. Copyright holders can generate additional revenue from their original works by licensing and transferring their rights, which permits other creators and third parties to reuse their works in exchange for a fee. Alternatively, copyright holders can strategically decide not to license or transfer their rights.

In the US, comic characters are eligible for TM protection as well as copyright protection. Comic books are distinctive since they contain not only verbal but visual elements. Hence, unlike fictional characters in novels, comic characters can also have a visually recognizable identity and representation, similar to those of word marks and logos. While words, short phrases, and titles generally cannot be protected under US copyright law, the brand or character name of a comic can be protected under US TM law. Logos (design marks) and the visual appearance (trade dress) of a comic character may be protected and eligible under both US TM and copyright laws (Wilkof and Basheer, 2012). As with copyrights, TMs can serve as a valuable source of licensing income for owners in the comic industry. By using TMs strategically, owners can limit licensing and temporarily prevent other parties from reusing trademarked comic characters.

A TM registration at the United States Patent and Trademark Office (USPTO) grants nationwide exclusive rights to the owner of the TM. After filing a TM application, the USPTO examines whether all registration requirements are met, mainly by verifying that the mark is not confusingly similar to an existing TM and is sufficiently distinctive.[5] Additionally, the applicant has to show that the TM has been used over the five years prior to the application or the applicant has to intend to use it within a specific period of time.[6] This use of trademarked content by the TM owner is reflected as first-party reuse in our data, while we refer to third-party reuse if the TM is licensed and the comic character is reused by a party other than the TM owner or the copyright holder.

As soon as the initial term of TM protection elapses – usually 10 years – and on payment of a fee, the term can be renewed indefinitely. If a TM owner wants to renew the TM protection of a comic character, they have to provide evidence of continued use in commerce. This minimum-use requirement in US TM law has economic implications for the amount of first-party reuse we can observe in our data. More specifically, it means that the TM owner (the first party) may be incentivized to reuse the TM more than they otherwise intended in order to comply with the minimum-use requirement; meanwhile, third-party reuse requires licensing by the first party.

Registering a TM requires the applicant to choose from a list of categories, so-called Nice classes, that specify the markets in which the TM should be used. Nice Classification is an international system for classifying goods and services that was established by the Nice Agreement in 1957.[7] The system currently distinguishes between 45 classes, ranging from chemicals (for example, salt) to legal services (for example, surveillance services). While national jurisdictions differ regarding whether they allow TM registrations of public domain works (Derclaye, 2017), the US system seems more willing to accept and make comic characters eligible for protection (Saval, 2013).

Trademarked comic characters are mostly registered in Nice classes 16 (paper, cardboard, and certain goods made of those materials)

[4] Under US copyright law, creators are granted exclusive rights to their works for their lifetime plus 70 years. Works made for hire are protected for 95 years from the date of first publication or 120 years from the date of creation, whichever is shorter. Most comic books are works made for hire.

[5] As soon as the TM registration has been granted, opponents are given a 30-day period to oppose the mark. During this period, any party that is convinced that the TM should not be granted may file an appeal against it with the USPTO. Depending on the final decision concerning the appeal, the TM will continue to be registered or will be invalidated. After a five-year period from the date of registration, the TM owner may obtain a declaration of incontestability that limits the risk of invalidation of the mark for the rest of its lifetime (Fink et al., 2022).

[6] Current US TM law allows for an exceptional proof of use within five to six years after the first USPTO registration.

[7] See https://www.wipo.int/classifications/nice/en/.

and 9 (audiovisual and information technology such as photography, cinematography, and computer software) (Adams, 2019).[8] Prominent examples of trademarked comic characters include Mickey Mouse (that is, the design mark of the Mickey Mouse cartoon character; registration no. 3598848) and Batman (the design mark of the Batman cartoon character; registration no. 4871024) (Calboli and Ginsburg, 2020). Additional Nice classes are relevant to comic characters (for example, toys [in Nice class 28] or textiles and clothing [in Nice classes 24 and 25]). However, we do not have access to the corresponding quantity or revenue data on reuse in these classes.

2.3. How TMs affect reuse in the comics industry

We focus on three broad mechanisms through which TMs can affect reuse: (1) changes in the market environment that come with digitization, (2) exclusion of third parties, and (3) licensing to third parties.

Digitization has lowered the costs of production, promotion, and distribution in the comics industry, and this reduction has lead to a large increase in the supply of comic books, movies, and video games. Some of the expansionary effect of digitization might be driven by the use of IPRs and the corresponding new options for commercialization and efficient licensing, especially of TMs. Thanks to the cost advantages due to digitization, which potentially allow for more reuse by third parties, TMs that enable reuse have become more valuable. Consequently, the expected lifetime licensing income from TMs has increased. But even though we observe a vast increase in the number of products in the market in the era of digitization, the number might have been even higher if IPRs, and specifically TMs, did not limit the reuse of creative content. This is especially true because digitization has decreased information frictions, making it easier to enforce IPRs. Put differently, as TMs can enable or block reuse, and since technological change makes reuse cheaper, they have become more valuable. In our empirical analysis, we use the variation that comes from digitization-led changes in the market environment to study the exclusion and licensing mechanisms.

One societal benefit of TMs is lower search and transaction costs for consumers (Landes and Posner, 1987). TMs are of particular importance as quality indicators for products in creative industries. However, TMs can help firms to differentiate their content and command premium prices (Lunney Jr., 1999), and such firms can deter entry and prevent imitation (Appelt, 2009; Fosfuri and Giarratana, 2009). For example, firms with larger stocks of TMs (in addition to other IPRs) are less likely to release software as open-source software, which is especially prone to be used by third parties (Fosfuri et al., 2008). Another important characteristic of TMs is that they can prolong the validity of other IPRs. This implies that TMs may be filed strategically (WIPO, 2013; Castaldi et al., 2020). Again, this is particularly relevant in the creative industries, in which creative-asset owners might not want to rely on copyright alone because of its relatively limited term of protection (Castaldi, 2018). For example, the renewal of TMs for comic characters might enable perpetual protection and grant characters such as Batman never-ending stories. Furthermore, the "resurrection" of IPRs can bring public domain content back into the realm of formal IP protection (Dusollier, 2010; Senftleben, 2012). Additional TM protection may alter the balance between incentivizing creative work and providing access to such works that were originally created under the scope and duration of copyrights. The limiting effects of TMs are further amplified when copyright and TMs are applied simultaneously and create high transaction costs and cause royalty stacking (Farrell et al., 2007; Spulber, 2017; Galetovic and Gupta, 2020).[9]

On the other hand, TMs can enable the creation of new products and business opportunities (Besen and Raskind, 1991; Lechner et al., 2016), effectively establishing markets for brands (Castaldi, 2020). The practice of using both copyrights and TMs to control the creative reuse of original works in franchise movies and video games is prevalent.[10] Reusing characters in franchise products typically bears lower commercial risk (compared to introducing new characters), as the content has previously been tested in the market.[11] Trademarking can enhance the overall appropriability conditions pertaining to franchises and merchandising activities (Buoye et al., 2020). As movie and video game producers usually do not possess the rights to the original stories of the characters, we expect them to incur licensing fees before introducing franchise products. Negotiations concerning IPRs are intricate when it comes to creating new franchise products that feature multiple comic characters.[12] Consequently, licensing related to merchandise and franchise products is a significant revenue source, particularly for prominent publishing houses. It can also serve to finance new franchise products (Epstein, 2012; Hart, 2015; Ferrucci et al., 2020).

3. Data and methods

3.1. Data

This section provides detailed information on all data sources that we combine (see Table 1). First, we gather data on fictional characters in comics, including their publishing information, from the Grand Comics Database, a comprehensive user-generated database on millions of characters created and first published since 1783. Our sample includes all publications from 1990 to 2017.

Second, we include information on TM registrations from the TM-Link Database, developed by the Australian IP office in cooperation with Swinburne University of Technology (Petrie et al., 2020). For our analysis, we focus on Nice classes 9 and 16, which are especially important when it comes to TMs for comic characters. Our approach to matching characters and TMs follows (Adams, 2019) in limiting matches to characters with at least one US TM registration in Nice class 16 (print TMs). To merge the two data sets, we use the TM text and characters (for example, word[s], letter[s], or number[s]) in the TM-Link Database, on one side, and the name of the comic character in the published comic series from the Grand Comics Database, on the other

[8] WIPO's Nice Classification defines Nice class 16 as "books; publications; magazines; stationery; adhesives for stationery or household use; paint brushes; playing cards; posters; decals; printed matter; artists' materials in class 16; cards; modeling materials; paper knives." Nice class 9 contains "computer game discs; computer game software; interactive multimedia computer game programs; interactive video game programs; video game discs; video game software; downloadable electronic publications in the nature of computer game instruction manuals, rule books for playing games, and magazines and journals on the subject of war games, skirmish games, role playing games, battle games, and fantasy/science fiction games".

[9] Royalty stacking refers to situations in which there is the additional financial burden of transferring or licensing multiple rights at excess royalties (Farrell et al., 2007; Galetovic and Gupta, 2020).

[10] A prominent example is the *Avengers* blockbuster and video game series set in the billion-dollar Marvel Cinematic Universe, with superheroes such as Ant-Man and She-Hulk first appearing in Marvel's original comic book series.

[11] The 2019 film *Joker*, for example, tells the backstory of the famous eponymous comic character who has been fighting Batman in the DC comic series since 1940. Even if Batman does not appear in the movie and there are no superpowers used or any science fiction effects, the affiliation of the movie with the underlying comic series is obvious. Hence, reusing popular comic content resulted in revenue of over one billion US dollars in worldwide box office sales.

[12] See, for example, the anecdotal evidence and discussion in the media: https://www.cinemablend.com/news/2471119/what-about-x-men-the-rights-issues-that-complicate-marvel-and-disneys-mcu, http://www.genericfairuse.com/2016/03/10/deadpool-and-ip-copyrights/.

Table 1
Data sources (1990–2017).

Source	Available information	Geographical coverage
Grand Comics Database	All comic publishing information, incl. US copyright status	Mainly US
TM-Link Database	All trademark information	US
USPTO Assignment Database	Licensing information on trademarks	US
GiantBomb	Video game reuse information	Mainly US
MobyGames	Video game reuse information	Global
Box Office Mojo	Movie reuse information	Mainly US
TMDB	Movie reuse information	Global
ReadComicsOnline	Comic book piracy information	Global

side, as identifiers.[13] To identify comic characters better and exclude false-positive matches with textual TMs, we employ two techniques. The fuzzy-matching approach developed by Raffo (2019) allows for fuzzy similarity between two text strings and helps us improve the quality of matches when combining databases. We use this method to compare the names of the TM applicants to the name of the publisher. If these names are highly similar (that is, the similarity score is at least 60%), we assume that the registered TM is related to a comic character. Additionally, we identify the 100 most frequent TM applicants in the data and inspect manually whether they are tied to the comics industry or related industries. If there is no clear connection to such industries, we exclude a match. Next, we add observations from the initial TM-Link Database that have the same family-group ID but for which a franchise TM application was filed in Nice class 9, which is associated with video games and motion pictures (Ferrucci et al., 2020).[14]

As our aim is to analyze the relationship between the TM registration of a comic character and its reuse in print and franchise media, we then collect information on derivative movies and video games. Our reuse data come from various online sources. We extract the relevant information on the franchise reuses of original and trademarked comic characters from GiantBomb and MobyGames for video games and from Box Office Mojo and TMDB for movies. We further validate the information through Wikipedia lists, including movies and video games for each character. Again, we match copyright-protected and trademarked characters to their reuse in movies and video games via their names as recorded in the publishing and franchise databases.

Next, we add data from the USPTO Trademark Assignment Database, which is described in detail in Graham et al. (2018). This allows us to include in our analysis licensing deals and the transfer of ownership of TMs for comic characters. We rely on the USPTO assignment database because it is the only official source of information on TM licensing. However, a limitation of these data is that they are voluntarily self-reported and therefore incomplete. After limiting the panel to TM registrations at the USPTO, we arrive at 49,369 comic characters, including 1,561 trademarked characters, of which 1,379 are only in Nice class 16, 530 are only in Nice class 9, and 348 are in both.

Finally, following (Hardy, 2021), we gather data on the online piracy of comic characters from ReadComicsOnline. We scrape the whole list of comic characters available on the piracy website and then merge this list with the reuse panel. We match 2,598 comic characters in this way.

The corresponding descriptive statistics are reported in Table A.1 in the appendix. All trademarking information is restricted to the US.

[13] In the TM-Link Database, the corresponding variable is called *trademark_text*.

[14] All TMs within one family-group ID belong to the same comic character. Hence, if a TM application was filed in several TM offices, the family-group ID indicates that the applications are linked to the same character. The authors of the TM-Link Database group families of TMs via machine-learning techniques. However, as these techniques are not perfect, most word marks are included but, for example, figurative marks are not.

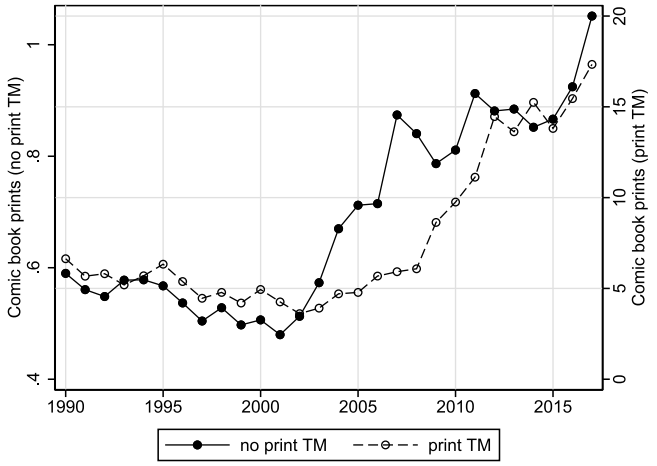

Fig. 2. Average number of annual comic books by print TM registration status
Note: The plotted data is at the character level. For example, comic characters for which a print TM was registered appeared on average in about 6 printed comic books in 1995, whereas the number was 10 in 2010.

3.2. Estimation and identification

3.2.1. Descriptive evidence

Fig. 2 shows the average number of annual releases of print comic books that feature a particular character. We distinguish between characters that are protected by a print TM (Nice class 16) at any point in our observation period (treatment group) and the rest (control group). The solid line represents characters without a print TM registration, whereas the dashed line represents characters protected by a print TM.

The trends are relatively flat and similar for both types of characters until about 2002. After that, the average number of prints for each group increases. This means that in the era of digitization, comic book prints for the treatment and control groups have trended upward. This is consistent with the notion that the fixed costs of production, promotion, and distribution decreased for all types of comic character. However, we see a significant difference in the slope of the two lines. Comic characters with a print TM registration experience a much slower increase in derivative comic book prints than characters that are not protected by a print TM. These descriptive findings motivate us to devise an estimation strategy that explicitly takes into account both heterogeneity in the treatment and changes in the relationship between TM registration and reuse over time.

3.2.2. Estimation strategy

In our empirical analysis, we first test whether a comic character survives to the next year if it is trademarked. If it survives, we take into account how often a character is reused in a comic book per year. This means that we look at two dependent variables. First, we examine the relationship between a print TM registration and the probability of publication in a given year of at least one comic book in which the character appears (*Prob. Reuse*). Here, our binary dependent variable

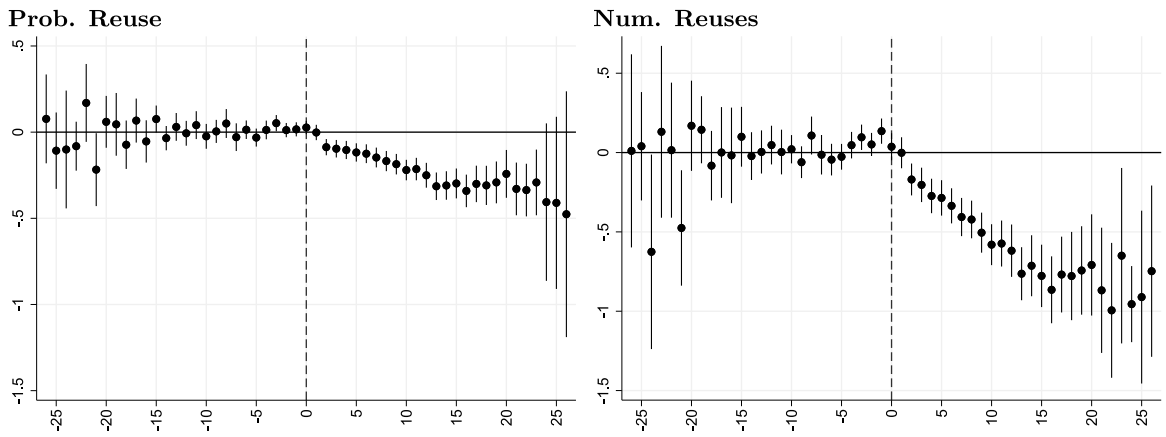

Fig. 3. Reuse in comic books before and after TM registration, Callaway and Sant'Anna's (2021) method
Note: Estimates of dynamic average treatment effects on the treated based on the CS method, with an indicator of at least one comic book release per year (left panel) and the log(+1) number of comic book releases per year (right panel) as the dependent variables. The dots reflect cohort- and time-specific point estimates. The horizontal axis gives relative time—that is, n years before and after the TM registration. The comparison is with characters that have not yet been trademarked. Characters that are never trademarked or that are protected by an additional franchise TM are excluded from the panel. Standard errors are clustered at the character level, and bars indicate 95% confidence bands.

Prob. Reuse takes the value of 1 if we see at least one comic print in a certain year for a comic character in our data and 0 otherwise. This may provide evidence that characters die out because firms invest less or prevent third-party reuse as soon as a character is under TM protection. Second, we look at the number of comic books printed per year (*Num. Reuses*). In this case, the dependent variable, *Num. Reuses*, is the logarithmic transformation of the total number of comic books in which a character appears per year.[15] In this way, we can quantify how many more comic books would have been produced in the absence of additional TM protection. Additionally, we examine the relationship between TM registration and subsequent movie and video game releases based on franchise products featuring comic characters.

The first specification to run is the classical two-way fixed-effects (TWFE) setup:

$$Y_{ikt} = \alpha + \delta TM_{ijt} + \eta_t + \mu_i + \varepsilon_{ikt}, \tag{1}$$

where Y_{ikt} is a measure of reuse of character i in medium k (comic book, video game, or movie) in year t. The main variable of interest is TM_{ijt}. It indicates that comic character i is protected by a TM of type j (print or franchise, depending on medium k) in year t. Put differently, characters that are protected by a TM at time t belong to treatment cohort t. The model includes year (η_t) and character fixed effects (μ_i), and we report clustered standard errors at the character level. However, recent studies have shown that the estimate of the average treatment effect on the treated (ATT) can be biased in TWFE models with multiple treatments and heterogeneous effects (Goodman-Bacon, 2021; Baker et al., 2022). Hence, we use Callaway and Sant'Anna's (2021) (CS) method to estimate the ATT. Their method enables a clean comparison of treated characters and not-yet-treated or never-treated characters. Since we are not interested in group-specific effects (for example, how TMs registered in 1994 affect reuse) but in the average effect, we report results using the simple aggregation described in equation 3.2 in CS.

Additionally, to study the mechanisms by which TMs affect reuse, we take treatment heterogeneity explicitly into account. Since the CS method does not allow treatment effects to be aggregated for groups of cohorts or groups of time units and does not allow us to test for differences across cohorts and time, we do so by introducing interaction terms to the TWFE specification:

$$Y_{ikt} = \alpha + \delta TM_{ijt} + \gamma_t TM_{ijt} \times T_{it}(1 + \gamma_c C_i) + \eta_t + \mu_i + \varepsilon_{ikt}, \tag{2}$$

where T_{it} indicates a group of time units (specifically, years after digitization) and C_i indicates a group of cohorts (either TMs of copyright owners or TMs that are licensed to third parties).

We acknowledge that this specification does not allow for the same comparison of treated characters to not-yet-treated or never-treated characters as the CS method. However, since we are more interested in the direction of the relationship than in a precise measurement of its magnitude, and given that we find consistent results with both methods, we do not think that this is a cause for major concern.

4. Results

4.1. Dynamics and causality

Since TM registration is an endogenous choice, it is difficult to draw strong causal conclusions from our analysis. As we describe in detail below, we compare all comic characters with those protected by at least one type of TM. This is to mitigate endogeneity concerns that stem from selection issues. Since both estimation strategies (CS and TWFE with interactions) are essentially difference-in-differences approaches, it is important to check whether the parallel-trends assumption holds. We provide evidence that it does in Figs. 3 and 4.

In Fig. 3, we plot the ATT estimates using the CS method, aggregated for each cohort by time before and after the year of TM registration. That is, for cohort t, we plot $-T$ estimates before the cohort is protected by a TM to check for anticipation effects and the parallel-trends assumption, and we plot T estimates after the cohort is protected by a TM to investigate heterogeneous time effects. For both dependent variables (*Prob. Reuse* and *Num. Reuses*), we see less reuse the more time has passed since registration. Additionally, the plot shows a nonlinearity that seems to reflect TM renewal deadlines at the USPTO (that is, 10 and 20 years after the initial TM registration).

In Fig. 4, we switch from relative time to calendar time and plot yearly differences between characters that are protected by TMs and those that have not yet been trademarked—that is, the $\delta_\tau \gamma_\tau$ coefficients obtained from the following model:

$$Y_{it} = \alpha + \beta\, TM_{it} + \sum_{\tau \in T} \delta_\tau \left(\gamma_\tau \times TM_{it}\right) + \mu_i + \varepsilon_{it}, \tag{3}$$

where we choose 2002 as the reference year in accordance with the discussion in Section 2.1 (and the descriptive analysis in Fig. 2) of

[15] When using the logarithm of our dependent variable, we transform the underlying measure such that our dependent variable becomes *Num. Reuses* $= log(prints + 1)$. As a robustness check, we go back to the simple specification $log(prints)$ and do not find a large difference in the relationship, so we do not need to explicitly control for the findings of Bellego et al. (2021).

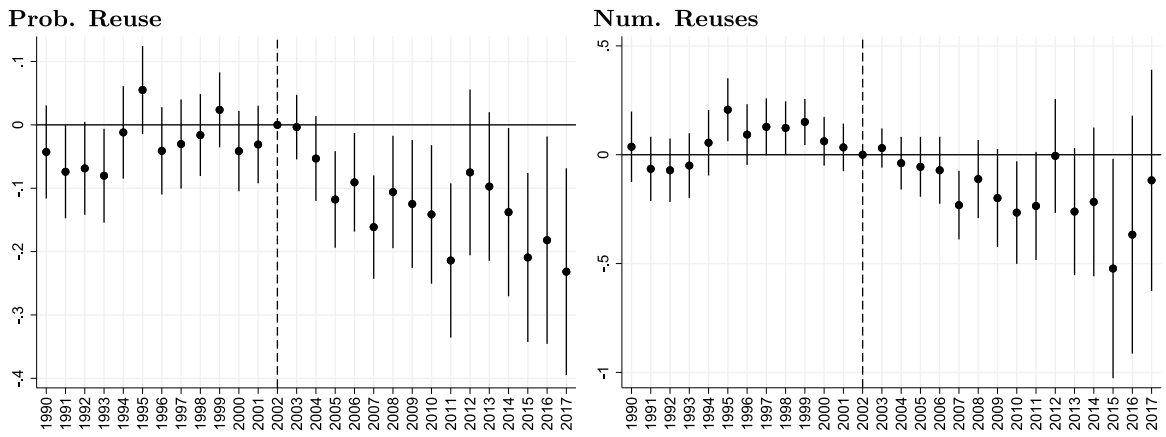

Fig. 4. Reuse in comic books over time, TWFE with interactions
Note: Two-way fixed-effects (TWFE) estimates of the δ_τ coefficients are obtained from variants of Eq. (3), using an indicator of at least one comic book release per year (left panel) and the log(+1) number of comic book releases per year (right panel) as the dependent variables. The omitted year is 2002. The dots reflect year-specific point estimates comparing the trademarked characters to not-yet-trademarked characters. Characters that are never protected by a TM or that are protected by an additional franchise TM are excluded from the panel. Standard errors are clustered at the character level, and bars indicate 95% confidence bands.

Table 2
Baseline results: reuse in comic books.

	Prob. Reuse		Num. Reuses	
	(1)	(2)	(3)	(4)
	All	Print TM	All	Print TM
ATT	−0.1802***	−0.1949***	−0.3366***	−0.4977***
	(0.0166)	(0.0288)	(0.0358)	(0.0657)
Observations	1363455	18110	1363455	18110
Mean DV	0.1420	0.3614	0.1814	0.7403

Note: The dependent variable in columns (1) and (2) is a dummy that takes the value of 1 as soon as the comic character appears in at least one comic book in a certain year. The dependent variable in columns (3) and (4) is the log(+1) number of comic book prints in a certain year. Estimates of the average treatment effect on the treated (*ATT*) are based on the CS method. *All* indicates that the comparison group includes characters that are never trademarked and those that have not yet been trademarked. *Print TM* indicates that the comparison group only includes characters that have not yet been protected by a print TM. Characters that hold an additional franchise TM are excluded from the panel. Character and time fixed effects are in all specifications. Standard errors are in parentheses and clustered at the character level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

various events that jointly form the era of digitization in the comics industry. For both dependent variables, the estimates indicate that the parallel-trends assumption in the time before digitization cannot be rejected. After 2002, however, we find significant negative relationships between a print TM registration and, first, the probability of at least one comic book release (left panel) and, second, the logarithmic transformation of the number of yearly comic book prints (right panel). This specific choice of year is somewhat arbitrary, but as Fig. 4 shows, we could alternatively use 2000, 2001, 2003, or 2004 to define the era of digitization without substantially changing the results reported below. A range of robustness checks and placebo tests let us rule out a set of alternative explanations (see below in this section).

As noted, one should treat our results as correlational associations in the data because both the trademarking decision and the licensing decision are endogenous and might be correlated with unobserved factors in our estimation. In the following, we first focus on how a print TM registration affects the reuse of characters in print comic books. Later, we look at franchise comic products such as movies and video games.

4.2. Comic book prints

We first estimate the ATT across cohorts (that is, points in time at which characters receive TM protection) and across time (that is, calendar years) using the CS method. We report our baseline estimations in Table 2. The results differ slightly in the way we define our dependent variable and the underlying sample. In columns (1) and (2), the dependent variable *Prob. Reuse* captures whether there is at least one print publication with a character in a given year. In columns (3) and (4), the dependent variable *Num. Reuses* is the logarithmic transformation of the number of print publications with the character in a given year. By using different sample definitions, we aim to address endogeneity concerns associated with the selection of characters for TM protection. In columns (1) and (3), we base our regression on our full panel, which includes all characters—both those that are trademarked (in print, franchise, or both) and those that are never trademarked. The comparison group consists of characters that have never or have not yet been protected by TMs. This is the same underlying sample as in the plot of raw data in Fig. 2. The results in columns (2) and (4) are based on the subsample *Print TM*, which only includes characters that hold a print TM at some point in our observation period. Here, the comparison group includes only characters that have not yet been trademarked in print media. Across all specifications in Table 2, the results show a consistent and significant negative relationship between print TMs and comic book releases. The estimates in columns (1) and (2) suggest that, on average, TM registration is associated with an 18%–19% lower probability that at least one comic book with the trademarked character is released per year. Looking at the intensive margin, the results in columns (3) and (4) show that TMs are associated with a 34%–50% reduction in the number of released comic books per year.

Since registering a TM is endogenous, we focus on the sign of the estimates (that is, the reduction) rather than their implied magnitude. In the following, we investigate the mechanisms that reduce or increase reuse in the presence of TMs and then report on several robustness checks and placebo tests, all to test whether our baseline results are not driven by spurious correlations.

Table 3
Mechanisms: reuse in comic books, and changes in market environment.

	Prob. Reuse		Num. Reuses	
	(1) All	(2) Print TM	(3) All	(4) Print TM
Print TM	0.0854***	0.1331***	0.2571***	0.3524***
	(0.0121)	(0.0165)	(0.0300)	(0.0425)
Print TM ×Post 2002	−0.1427***	−0.1482***	−0.2386***	−0.3988***
	(0.0099)	(0.0206)	(0.0256)	(0.0512)
Lin. Comb. Row 1+2	−0.0573***	−0.0151	0.0185	−0.0464
Observations	1363455	18110	1363455	18110
Mean DV	0.1420	0.3614	0.1814	0.7403

Note: The dependent variable in columns (1) and (2) is a dummy that takes the value of 1 as soon as the comic character appears in at least one comic book in a certain year. The dependent variable in columns (3) and (4) is the log(+1) number of comic book prints in a certain year. *Post 2002* indicates years after 2002—the era of digitization. *All* indicates that the comparison group includes characters that are never trademarked and those that have not yet been trademarked. *Print TM* indicates that the comparison group only includes characters that have not yet been protected by a print TM. Characters that hold an additional franchise TM are excluded from the panel. Character and time fixed effects are in all specifications. Standard errors are in parentheses and clustered at the character level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

4.2.1. Changes in the market environment

As described above, the comics industry experienced an intense change in the market environment with the arrival of digital technologies. Lower costs of production, promotion, and distribution have enabled more entry, potentially including entry of third-party reusers. To investigate the dynamic effects across cohorts, we estimate a TWFE model with interactions as specified in Eq. (2).

The results in Fig. 4 and Table 3 suggest that the negative association we documented above occurs in the years after 2002. The estimated coefficients of *Print TM* in Table 3 are positive and statistically significant across all specifications, whereas those of *Print TM* × *Post 2002* are negative and statistically significant across all specifications. This is in line with the descriptive evidence in Fig. 2. Looking at the total average "effect" (the linear combination of rows 1 and 2), we see that we mostly obtain negative but nonsignificant estimates. Keeping in mind that the CS method gives more weight to estimates in the middle of the observation period, the difference from the results reported in Table 2 becomes clear.

Our results suggest that even though digitization has led to a vast increase in the production of comic books (see Fig. 1), some IPRs are associated with a reduction in supply. The implied magnitude of the estimates in Table 3 suggests that the probability of at least one print per year would have been 14% higher and that 40% more comic books would have been printed per year in the era of digitization in the absence of TMs. However, the TWFE method used here likely yields biased estimates of the ATT, in addition to the issue of endogenous trademarking. Because the results are consistent across sample definitions, we only report results from the *Print TM* sample in the remainder of the paper, essentially conducting a within-analysis of trademarked characters.

4.2.2. Exclusion of third parties

Having established that we can only find a significant and negative association of TMs in years after 2002 – when lower costs of production, promotion, and distribution enabled the large-scale entry of third-party reusers – we investigate additional mechanisms. First, we test whether the relationship changes if the comic book publisher is not the same entity as the TM registrant. The TM owner may choose to block third-party reuse, or they may be discouraged by the transaction costs of participating in the licensing market. When the TM owner and publisher are the same entity, we should expect that TM registration affects the likelihood or volume of comic book prints to a smaller extent. The binary variable *First-Party* indicates that the TM applicant is the same entity as the comic book publisher.[16] The results reported in columns (1) and (2) of Table 4 suggest that the negative association between TM registrations and comic book prints is reduced if the TM applicant is the same as the copyright holder. This becomes evident from the positive point estimates of *Print TM* × *Post 2001* × *First-Party*. Our estimates of first-party reuse are likely a lower bound, as the TM owner may reuse the TM more than they otherwise intended in order to comply with the minimum-use requirements of US TM law.

4.2.3. Licensing to third parties

With TM protection, only the rights holder(s) can reuse the character in new comic books and license these rights to third parties. Our results so far suggest that the supply-limiting effects of TMs outweigh the potential supply-enhancing effects. However, if rights holders choose to participate in licensing markets, the balance might swing toward more third-party supply. The time-invariant variable *Licensed* in columns (3) and (4) of Table 4 indicates that the comic character's TM is licensed or transferred at least once in the observation period. The results suggest that comic characters with print TMs but no licensing have a 14% lower probability of print publication and a 32% lower number of reuses in print publications. As expected, since a licensed TM implies the TM registrant has no exclusive right to reuse a comic character, there is relatively more reuse. This indicates that well-functioning markets for licensing and transferring TMs can moderate the negative relationship with reuse that we observe. The linear combination *Print TM* × *Post 2001* + *Print TM* × *Post 2001* × *Licensed* does not yield a significant point estimate for the probability of reuse, so the total "effect" is not significantly different from zero.

Importantly, however, the decision whether to license is endogenous. The same applies to the decision to register a TM in the first place. This is an important caveat of our study that warrants further exploration in future research.

4.3. Franchise products of comic characters: movies and video games

Next, we extend our analysis to the relationship between franchise TMs and the franchise products of comic characters. Again, we report results when estimating the ATT with the CS method and when using TWFE estimations with time-period interactions to study dynamic effects.

We first focus on the reuse of comic characters in movies. The results in columns (1) and (2) of Table 5, estimated using the CS method, suggest that, on average, there is no significant relationship between TMs and reuse in movies. This is the case for both the probability of

[16] To be more precise, *First-Party* indicates whether the applicant name recorded in the TM file is highly similar to the original publisher of the character. Again, we apply the fuzzy-matching approach developed by Raffo (2019).

Table 4
Mechanisms: reuse in comic books, and first-party reuse and licensing.

	First vs. Third-Party Reuse		Licensed	
	(1) Prob. Reuse	(2) Num. Reuses	(3) Prob. Reuse	(4) Num. Reuses
Print TM ×Post 2002	−0.1734***	−0.4145***	−0.1319***	−0.3173***
	(0.0273)	(0.0634)	(0.0225)	(0.0542)
Print TM ×Post 2002 ×First-Party	0.0948**	0.0832		
	(0.0383)	(0.1025)		
Print TM ×Post 2002 ×Licensed			0.0439	−0.0177
			(0.0611)	(0.1451)
Lin. Comb. Row 1+2	−0.0786***	−0.3313***		
Lin. Comb. Row 1+3			−0.0880	−0.3350**
Observations	17573	17573	18110	18110
Mean DV	0.3663	0.7539	0.3614	0.7403

Note: The dependent variable in columns (1) and (3) is a dummy that takes the value of 1 as soon as the comic character appears in at least one comic book in a certain year. The dependent variable in columns (2) and (4) is the log(+1) number of comic book prints in a certain year. *Post 2002* indicates years after 2002—the era of digitization. *First-Party* indicates that the TM applicant is the same firm that published the comic character for the first time and is therefore the copyright holder. *Licensed* indicates that the comic character's TM is licensed or the TM is transferred at least once in the observation period according to the USPTO Trademark Assignment Database. The estimations are based on the *Print TM* panel, indicating that the comparison group only includes characters that have not yet been protected by a print TM. Characters that hold an additional franchise TM are excluded from the panel. Character and time fixed effects are in all specifications. Standard errors are in parentheses and clustered at the character level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 5
Franchise products: movie releases, 1990–2017.

	CS		TWFE Interactions	
	(1) Prob. Reuse	(2) Num. Reuses	(3) Prob. Reuse	(4) Num. Reuses
ATT	−0.0165	−0.0148		
	(0.0202)	(0.0153)		
Franchise TM			0.0161	0.0114
			(0.0108)	(0.0075)
Franchise TM ×Post 2002			−0.0244*	−0.0180*
			(0.0143)	(0.0101)
Lin.Comb. Row 2+3			−0.0084	−0.0066
Observations	4239	4239	4239	4239
Mean DV	0.0236	0.0166	0.0236	0.0166

Note: The dependent variable in columns (1) and (3) is a dummy that takes the value of 1 as soon as the comic character appears in at least one movie in a certain year. The dependent variable in columns (2) and (4) is the log(+1) number of movie releases in a certain year. Estimates of the average treatment effect on the treated (*ATT*) are based on the CS method. *Post 2002* indicates years after 2002—the era of digitization. The estimations are based on the *Franchise TM* sample, indicating that the comparison group only includes characters that have not yet been protected by a franchise TM. Characters that hold an additional print TM are excluded from the panel. Character and time fixed effects are in all specifications. Standard errors are in parentheses and clustered at the character level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

at least one reuse per year and the total number of reuses per year. Looking at the results from the TWFE specification with time-period interactions in columns (3) and (4), we again see a split around the year 2002. As with the reuse of comic characters in print publications, we see less reuse of trademarked characters in movies after 2002. The probability of reuse in a movie is about 2% lower per year if the character is protected by a franchise TM. Similarly, the number of annual movie releases drops by 2%. The total "effect" (the linear combination of rows 2 and 3), however, is not statistically significant, which is consistent with the results in columns (1) and (2).

Turning to reuse in video games in Table 6, we reach similar conclusions. In columns (1) and (2), we again see that there is, on average, no significant relationship between TMs and reuse in video games, both for the probability of reuse and the number of reuses per year. The results from the TWFE specifications with time-period interactions in columns (3) and (4) suggest that TMs are associated with 9% less reuse in video games from 2003 to 2017 compared to the period 1990–2002. Again, however, the total "effect" (the linear combination of rows 2 and 3) is not statistically significant. As with the results on reuse in movies, this is consistent with the results from the CS method in columns (1) and (2).

We conclude first that the relationship between TMs and reuse varies by the type of media franchise. Second, TMs are significantly and negatively correlated with reuse within the same type of media and show even more pronounced coefficients in the era of digitization.

4.4. Robustness checks and limitations

A few issues threaten the internal validity of our study.

Figs. 3 and 4 provide evidence for common trends in reuse before comic characters are protected by TMs. Using character fixed effects absorbs time-invariant unobserved across-character heterogeneity that may be correlated with unobserved factors that determine the trademarking or licensing choice. Similarly, restricting the analysis to only characters that are eventually protected by a TM (with a clean comparison between trademarked characters and never-trademarked or not-yet-trademarked characters using the CS method) should alleviate further concerns. Nevertheless, we conduct additional robustness checks to test alternative explanations for our findings.

First, we perform placebo regressions. We look at the relationship between a franchise TM registration and comic book prints and compare it to the relationship between a print TM registration and comic book prints. The variable *Franchise TM* takes the value of 1 as soon as a franchise TM is registered and 0 beforehand. Columns (1) and (2) in Table A.2 reflect the nonsignificant regression coefficients of a franchise TM registration on the probability of comic book prints

Table 6
Franchise products: game releases, 1990–2017.

	CS		TWFE Interactions	
	(1) Prob. Reuse	(2) Num. Reuses	(3) Prob. Reuse	(4) Num. Reuses
ATT	−0.0114	−0.0149		
	(0.0274)	(0.0244)		
Franchise TM			0.0780**	0.0707**
			(0.0351)	(0.0322)
Franchise TM ×Post 2002			−0.0946**	−0.0903**
			(0.0389)	(0.0347)
Lin.Comb. Row 2+3			−0.0166	−0.0196
Observations	4239	4239	4239	4239
Mean DV	0.0828	0.0672	0.0828	0.0672

Note: The dependent variable in columns (1) and (3) is a dummy that takes the value of 1 as soon as the comic character appears in at least one video game in a certain year. The dependent variable in columns (2) and (4) is the log(+1) number of video game releases in a certain year. Estimates of the average treatment effect on the treated (*ATT*) are based on the CS method. *Post 2002* indicates years after 2002—the era of digitization. The estimations are based on the *Franchise TM* sample, indicating that the comparison group only includes characters that have not yet been protected by a franchise TM. Characters that hold an additional print TM are excluded from the panel. Character and time fixed effects are in all specifications. Standard errors are in parentheses and clustered at the character level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

and the number of comic book releases per year. This result also is evident in Fig. A.1. The left panel reports the regression coefficients of our estimated relationship between a franchise TM registration and the probability of a comic book print per year, whereas the dependent variable in the right panel is the log(+1) number of annual comic book releases. Before and during the era of digitization, neither of the graphs shows statistically significant variation between the treatment group and the control group, suggesting the assumption of parallel trends before 2002 is valid, but after that, we see a nonsignificant result. Overall, and as expected, we do not find a statistically significant correlation with comic prints when a TM protects nonprint outputs.

Second, comic book producers might face pressure on their revenues from online piracy. They might compensate for piracy risk by increasing TM protection of their characters. To test this alternative explanation, we take into account whether a comic character appears on the piracy website ReadComicsOnline.[17] The dummy variable *Pirated* is time invariant per character and takes the value of 1 if a comic character appears on ReadComicsOnline and 0 otherwise. The results reported in columns (3) and (4) in Table A.2 show that the overall result does not change in comparison to the baseline results in Table 3. The linear combination yields a sizable and statistically significant point estimate. Hence, the results suggest that the reduction in comic book prints is likely not entirely driven by lower revenues due to piracy. Again, these results come with the caveat that appearing on a piracy website is endogenous (Hardy, 2021).

While we can rule out some alternative explanations and provide evidence that is consistent with theoretical predictions, we cannot interpret our results as clear-cut causal evidence we must keep the limitations of our study in mind.

It is plausible that firms file TMs for comic characters strategically. TMs allow them to exercise market power and block further comic book prints or limit other parties' access to certain intellectual property assets. And rights holders might charge prohibitively high licensing fees to third parties, leading to a breakdown in the licensing market. In this way, IPRs might constitute a source of market power, and competition-policy issues may arise. Bradley and Kolev (2023) show that with increased competition, such as in the presence of piracy, firms increase their TM protection in addition to other, existing IPR protections. Clearly, TMs that serve as add-ons to copyright protection need additional rights clearance. As overlapping IPRs can increase transaction and licensing costs, this area requires more research, in particular with regard to welfare implications.

Finally, because we used a large sample of comic characters, we had to simplify our data-matching techniques. This approach may have resulted in oversampling of larger TM-applicant firms.

5. Conclusions

This paper empirically investigated the relationship between TMs and reuse in the comics industry. We used an original combination of data sources on the US comics industry between 1990 and 2017 to analyze the relationship between TMs and the reuse of works in print, movies, and video games. Our results indicated that even if the overall trend of comics production is positive and supply increases, IP protection via TMs can limit the production of creative works under certain conditions. We found that the negative relationship between TMs and reuse varies over time. The relationship was most pronounced during the era of digitization, which has impacted the market environment in important ways and led to substantial cost declines in the comics industry. Furthermore, we showed that after content creators register US TMs, which extend beyond automatic copyright protection, there were fewer reprints of comic characters in books and fewer appearances in franchise movies and video games. In other words, by using strategic and exclusionary methods to limit use of their comic characters, TM owners can gain a competitive advantage that surpasses the potential benefits of licensing their IPRs to their competitors.

Our study focused on the US comics industry and did not account for the variety of comic characters originating from Asia and other regions of the world, such as Japan with its well-established manga and anime culture. Once better global data become available, researchers can study the international dimension of (franchise) reuses, rights transfer, and licensing. However, we already know from the EU system that trademarking copyright-protected comic characters is possible, so the economic relationship between TMs and reuse that we found in our study should not change significantly.

The comics industry serves as a valuable setting for observing TM registrations and the licensing of creative content that is already protected by copyright law. Less frequently, similar overlapping-IPR settings can also be observed in other creative industries, such as music and software products. For example, Taylor Swift trademarked the titles of her songs as well as parts of her lyrics, which are additionally

[17] ReadComicsOnline was founded in 2015, whereas most of the comic characters in our data were trademarked earlier, so we cannot use the founding year of the piracy website as an external shock. We, therefore, assume that all comic characters appearing on ReadComicsOnline have run the risk of being pirated since the beginning of digitization, which gave rise to online piracy.

Table A.1
Descriptive statistics by sample definition.

	All characters				
	Observations	Mean	SD	Min	Max
Prob. Reuse	1363455	0.1420164	0.3490671	0	1
Num. Reuses	1363455	0.1814257	0.5404226	0	7.71913
Print TM	1363455	0.0119359	0.1085974	0	1
Franchise TM	1363455	0.0045465	0.0672746	0	1
First-Party	29139	0.2017571	0.4013187	0	1
Licensed	1363455	0.986125	0.1169724	0	1
Pirated	1363455	0.0498036	0.4945166	0	1
	Print TM characters				
	Observations	Mean	SD	Min	Max
Prob. Reuse	18110	0.3614025	0.4804201	0	1
Num. Reuses	18110	0.7403472	1.250259	0	7.71913
Print TM	18110	0.6834346	0.4651491	0	1
Franchise TM	18110	0	0	0	0
First-Party	17573	0.2465714	0.4310273	0	1
Licensed	18110	0.4062949	0.4911544	0	1
Pirated	18110	0.475704	0.4994231	0	1

Table A.2
Robustness tests: comic book prints between 1990 and 2017.

	Franchise TM		Pirated	
	(1) Prob. of Reuse	(2) Num. Reuses	(3) Prob. of Reuse	(4) Num. Reuses
Franchise TM ×Post 2002	−0.0179	−0.0510		
	(0.0172)	(0.0474)		
Print TM ×Post 2002			−0.1518***	−0.2999***
			(0.0265)	(0.0514)
Print TM ×Post 2002 ×Pirated			0.0059	−0.1903**
			(0.0386)	(0.0939)
Lin.Comb. Row 2+3			−0.1459***	−0.4902***
Observations	42622	42622	18110	18110
Mean DV	0.3495	0.7425	0.3614	0.7403

Note: The dependent variable in columns (1) and (3) is a dummy that takes the value one as soon as the comic character appears in at least one comic book in a certain year. The dependent variable in columns (2) and (4) is the log(+1) number of comic book prints in a certain year. *Post 2002* indicates years after 2002, which one might refer to as the era of digitization. *Pirated* indicates that the comic character appears on the piracy website ReadComicsOnline. *Lin.Comb.* reflects the test for the linear combination of the coefficients. In columns (1) and (2), the estimations are based on the sample that was reduced to the group of characters that are protected by at least one TM, a print and/or franchise TM. In columns (3) and (4), the estimations are based on the *Print TM* panel, which was reduced to the group of characters that are protected by a print TM at some point in their life. Characters that hold an additional franchise TM were excluded from the panel. Character and time-fixed effects in all specifications. Standard errors in parentheses, clustered on the character level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

covered by copyright protection.[18] Likewise, patents serve as additional IPRs—for example, for software products (Graham and Mowery, 2003; Bessen and Hunt, 2007). With the emergence of nonfungible tokens, there is additional scope for exploring new overlapping-rights frameworks. For example, Marvel started to release official nonfungible-token collectibles in 2021.[19] These examples make it evident that overlapping-rights frameworks have to be cleared.

The goal of our paper was mainly to document the relationship between TMs and reuse in the growing creative industries. Drawing normative policy implications from our results is very difficult. Since we lacked access to pricing and demand data in both the licensing and final-consumer markets, we could not attempt a full welfare analysis. Therefore, it remains unclear whether the comic-related products that did not come to market because TM owners blocked third-party reuse would have had a significant impact on consumer welfare. Moreover, it would be interesting to explore whether the option to file a TM in addition to copyright protection affects creators' incentives to produce creative works in the first place. It is challenging to answer this question because overlapping IPRs prevent some of the most popular characters from entering the public domain. One example is the comic character Popeye, whose copyright term expired in the EU in 2009 but whose TMs will continue to protect the character for an indeterminate period.[20] In other cases, such as Winnie the Pooh and Cinderella, the original expression of the comic character is in the public domain, while the famous adaptations by Disney will remain protected by both copyright and TM laws for many years to come.[21] Beyond demonstrating the strategic value of TM use to rights owners, these cases exemplify the restrictions current overlapping IPRs can impose on follow-on creators. Our results suggest that hypothetical policies banning overlapping IPRs or requiring TM owners to license their content to third parties could increase output, but we do not know whether such policies would be consequential for consumers, firms, and the incentive to innovate.

Overall, our research provides several avenues for future research. Because copyright in the US lasts for 95 years from the year of the

[18] See https://www.gerbenlaw.com/trademarks/musicians/taylor-swift.
[19] See https://decrypt.co/74530/marvel-first-official-nft-collectibles.
[20] See https://medium.datadriveninvestor.com/intellectual-property-and-the-curious-case-of-popeye-1fb6932551e8.
[21] See, for example, https://www.plagiarismtoday.com/2022/01/05/what-winnie-the-pooh-lapsing-into-the-public-domain-really-means/ and https://cuttingforbusiness.com/8-characters-public-domain-crafters/.

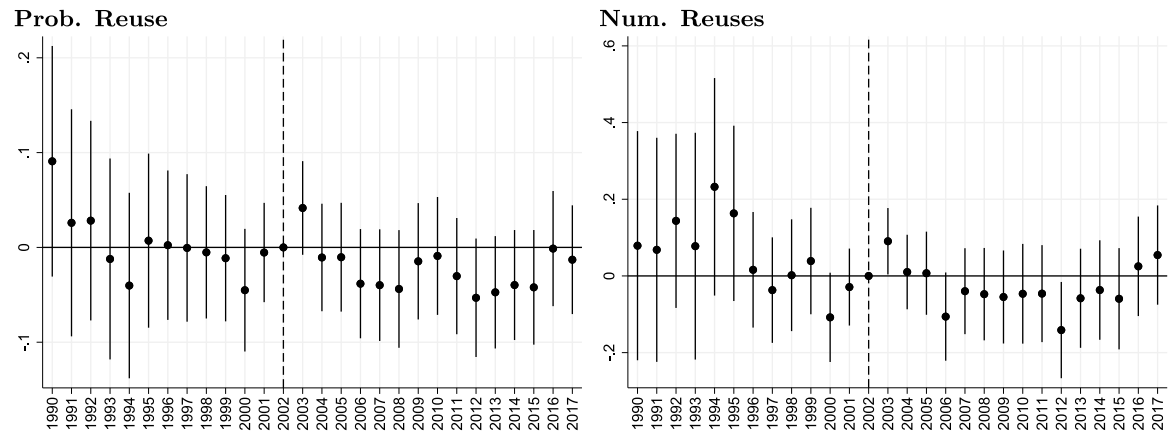

Fig. A.1. Comic book prints before and after a TM registration, placebo with franchise TM
Note: Two-way fixed-effects (TWFE) estimates of the δ_τ coefficients are obtained from variants of Eq. (3), using an indicator of at least one comic book release per year (left panel) and the log(+1) number of comic book releases per year (right panel) as the dependent variables. The omitted year is 2002. The dots reflect year-specific point estimates between the placebo treatment group (trademarked characters) and the placebo control group (nontrademarked characters). The underlying sample only includes characters that are protected by a print and/or franchise TM registration at some point in their life. Standard errors are clustered at the character level, and bars indicate 95% confidence bands.

first publication, many comic characters currently remain protected by copyright law. The majority of characters, which are not protected by TMs, will enter the public domain after the end of their copyright term—that is, within the next 10 to 20 years. Then, broad TM filings could bring public domain content back into the realm of formal IP protection. Future research could analyze the economic effects of such a resurrection of rights.

Our study focused on comics reuse in print, movies, and video games. However, comics are also reused in a wide range of physical products such as toys and clothing. Future research could study the reuse of comics in other physical products if access to the specific reuse and sales data can be obtained.

Thanks to the USPTO Trademark Assignment Database (Graham et al., 2018), we could take a closer look at the TM licensing of creative content for third parties. Settings with similar characteristics include patent and copyright licensing. A new data release from the US Copyright Office on copyright registrations may help researchers to further analyze the reuse of copyrighted content.[22] However, better licensing data need to become available for researchers to conduct detailed analyses of third-party versus first-party reuse.

CRediT authorship contribution statement

Franziska Kaiser: Writing, Conceptualization, Methodology, Formal analysis, Data curation, Project administration. **Alexander Cuntz:** Writing, Conceptualization, Methodology, Formal analysis, Data curation. **Christian Peukert:** Writing, Conceptualization, Methodology, Formal analysis.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request

Funding

Peukert acknowledges the support from the Swiss National Science Foundation for the project 100013_197807.

[22] See https://copyright.gov/policy/women-in-copyright-system/.

Appendix

See Tables A.1, A.2 and Fig. A.1.

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