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The Impact of Copyright Exceptions for Researchers on Scholarly Output

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Abstract

High prices restrict access to academic journals and books that scholars rely upon to author new research. One possible solution is the expansion of copyright exceptions allowing unauthorized access to copyrighted works for researchers. I test the link between copyright exceptions for health and science researchers and their publishing output at the country-subject level. I find that scientists residing in countries that implement more robust research exceptions publish more papers and books in subsequent years. This relationship between copyright exceptions and publishing is stronger in lower-income countries, and stronger where there is stricter copyright protection of existing works.

Key Words: *Copyright, Copyright Exceptions, Intellectual Property, Access to Knowledge, Knowledge Governance, Research, Publishing, Scholarship.*

JEL Codes: *O34, K11, D83*

Telif Hakkı İstisnalarının Araştırmacıların Verimi Üzerindeki Etkisi

Özet

Yüksek fiyatlar, akademik dergilere ve bilim insanlarının yeni araştırmalar için kullandıkları kitaplara erişimini kısıtlamaktadır. Bu sorunun olası bir çözümü, araştırmacılar için telif hakkıyla korunan eserlere yetkisiz erişime izin veren telif hakkı istisnalarının genişletilmesidir. Çalışmada sağlık ve bilim araştırmacılarının telif hakkı istisnaları ile ülke düzeyinde yayıncılık çıktıları arasındaki bağlantı test edildi. Telif hakkı için daha sağlam araştırma istisnaları uygulayan ülkelerde ikamet eden bilim adamlarının sonraki yıllarda daha fazla makale ve kitap yayınladığı sonucuna erişildi. Telif hakkı istisnaları ile yayıncılık arasındaki bu ilişki, düşük gelirli ülkelerde, mevcut eserlerin daha sıkı telif hakkı korumasının olduğu yerlerde daha güçlü olduğu görülmekte.

Anahtar Kelimeler: *Telif Hakkı, Telif İstisnaları, Fikri Mülkiyet, Bilgiye Erişim, Bilgi Yönetimi, Araştırma, Yayıncılık, Burs*

JEL Kodları: *O34, K11, D83*

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1. Introduction

The Academic Publishing Market and High Prices

The structure of the academic publishing industry allows publishers to charge high prices for books and journal articles. The top five commercial academic publishers wield oligopolistic market power, and the share of scientific papers published by the top five publishers has increased to over 50% between the 1990s and 2013 (Lariviere et al., 2015). The increase has been due to both acquisitions of smaller publishers, and the creation of new, specialized journals. Furthermore, journals' readers usually do not pay the full price for the product – individual scholars use the papers, but university libraries pay the subscription fees. Typically, libraries buy bundles of journals from publishers, which have the effect of lowering the price of each journal, but require institutions to purchase subscriptions they do not need (Gowers T. , 2012). While the average 2017 institutional subscription for "general science" titles cost $1556 (Bosch & Henderson, 2017), the cost of a publisher's bundle can reach into the hundreds of thousands, or even millions of dollars (Association of Research Libraries, 2019; Bergstrom, Courant, McAfee, & Williams, 2014).

Commercial publishers' market power is currently under threat from the rise of open access (OA) publishing. Many journal articles are now published in journals that make articles freely available to all, like *PLOS One.* Some universities are negotiating new types of contracts that allow for Open Access to their scholars' articles (Wilke, 2019). However, the commercially published journal is still the "dominant model" of publishing new scientific knowledge (Ellis, 2019). A major hurdle to the growth of OA – and market barrier protecting the commercial publishers' oligopoly – has been the fact that academic authors' career advancement is often based upon publication in the established, high impact journals (Larivière, Haustein, & Mongeon, 2015). Many scholars are wary of perceived high fees for review and publication in OA journals (Peters, et al., 2016), though OA advocates claim a majority of OA journals do not charge them (Suber, 2013). These hurdles have protected commercial publishers' market share, and much of today's academic and scientific literature is available mostly through university libraries or through high direct to consumer prices.

High Book and Journal Prices Can Restrict Access to Knowledge Goods

Not all researchers have the same degree of access to these expensive articles and books. Academic libraries in developing countries have well documented shortages of journals and books (Bannerman, 2014). Librarians and scientists have frequently voiced concerns over limited access to previous publications. Kleyn and Nicolson (2018) survey South African university libraries, and argue that prices have become unsustainable. Albert (2006) warns that rising prices have "hampered the ability of libraries, universities, and investigators to acquire publications necessary for research and education."

However, the problem is not found in developing countries alone. In 2002, a British commission studying intellectual property and development found that "even well-resourced libraries in developed countries are experiencing extreme difficulty in continuing to stock the full range of journals their academics and students expect. In developed countries the rapid increase in subscription prices for academic journals, and ongoing consolidation in the publishing industry has fueled an active debate on how researchers can maintain access to the materials they need." (Barton, et al., 2002). In the U.S. and other wealthy countries, libraries are beginning to push back against high subscription costs. This year, the University of California received a lot of attention when it cancelled its bundle contract with Elsevier (University of California, 2019), yet at least 53 other universities and university systems in developed countries have done this in the U.S. and Europe since 2008 (Association of Research Libraries, 2019). These cancelations have complemented a growing resistance from scholars worldwide, who question commercial publishers' role in the knowledge ecosystem and have launched a boycott of Elsevier under the banner "The Cost of Knowledge" (Gowers T. , 2012).

Lack of Access to Knowledge Goods Is a Barrier to the Creation of New Knowledge Goods

Scholars need to access existing books and journal articles to write new books and journals. Okediji (2019) notes that "although ideas are not copyrightable, the cultural goods that contain them are; people must be able to engage with these ideas in order to learn from them *and build on them*." [emphasis added] Kaube (2018) notes that scientists spend a great deal of time reading journal articles in order to guide their research. Ellis (2019) reports that scientists in the University of California system downloaded as many Elsevier articles as they could before their universities' subscriptions ran out.

Some previous literature focuses on problems of limited access to scholarly literature depressing scholarly output in the Global South. Adcock and Fottrell (2008) survey health researchers from nine developing countries, finding that poor access to current literature in their fields lessened their published output. Langer, Díaz-Olavarrieta, Berdichevsky, and Villar (2004) find limited access to published papers to be a barrier to further research into diseases prevalent in the South.

Copyright Exceptions Govern Unauthorized Access to Copyrighted Works

The problem of lack of access to published books and papers fits into a long-running debate among intellectual property policymakers over the proper strength and structure of copyright laws. Policymakers speak of finding the correct "balance" between providing adequate incentives for authors and adequate access to knowledge for consumers (Aufderheide & Jaszi, 2018; Zhang, 2014).

Copyright incentivizes the creation of new works by granting exclusive rights to sell and distribute them. In the academic sector, authors usually license their copyrights to commercial publishers, who then distribute the authors' works. The copyright license gives journals control over the reproduction and distribution of the authors' writings, so they can set whatever price the market will bear. When publishers set very high prices, some people are prevented from accessing the works.

However, in most countries the control of reproduction and distribution of copyrighted works is not absolute – it is balanced by *copyright exceptions*. These are provisions within copyright laws that define the types of uses of works that are permissible without the rightholder's authorization. They exist for a variety of purposes, including but not limited to research and education. Often, copyright exceptions are very specific about who can reproduce and/or share copyrighted works, and for what types of reasons (Samuelson, Justifications for Copyright Limitations and Exceptions, 2017), and these details vary greatly from one country to the next (Flynn & Palmedo, 2018). Some countries' laws also include a general exception – "fair use" or "fair dealing" – which permits use of a work for a broad field of purposes as long as the use meets certain factors to determine that it does not interfere with the rightholder's normal exploitation of her right (Samuelson & Hashimoto, 2018).

Various types of copyright exceptions may allow researchers to legally obtain books and articles which would be priced out of reach absent the exception. Some copyright laws have exceptions explicitly designed to help researchers to access works. An example is Australia's *Copyright Act* (1968), which states directly that a fair dealing "for purpose of research or study" is not an infringement of copyright. Some copyright laws have broadly worded educational use exceptions that permit researchers to share copies of articles for research purposes. Portugal's *Código do Direito de Autor e dos Direitos Conexos* (1985) allows people affiliated with educational institutions to share copies for research and educational purposes as long as this is done for non-commercial purposes.

However, other countries have very strict educational exceptions that limit how professors can share copies. For instance, professors in the Ukraine are permitted to share copies of articles with students in a classroom setting – but not to share copies with other researchers for reasons unconnected to classroom use (On Copyright and Neighboring Rights, 1993). Other types of copyright exceptions may also help scholars access and share works in order to conduct research. Burrel and Coleman (2005), for instance, describe how personal use and library lending exceptions in the UK can help scholars access works.

Some countries' laws may have multiple exceptions beneficial to researchers, but others may have few or none. Argentina's law has no limitations for research, personal use, or libraries, and its education exception only applies to audio visual works (Law 11723, 1933).

International copyright law shaped by the Berne Convention and the WTO's Agreement on Trade Related Aspects of Intellectual Property Rights (TRIPS) recognize copyright exceptions as integral parts of Member nations' laws. Okediji (2019) notes that exceptions are the international copyright system's "primary instrument" for achieving social goals such as expanding access to knowledge through education, though in their current form they have not functioned adequately in developing countries to achieve these goals. To permit the use of copyright exceptions while preserving copyright's incentives for creators, the agreements place boundaries on the breadth of copyright exceptions through what is known as the three-step test (UNCTAD-ICTSD, 2005). TRIPS Article 13 phrases the three-step test as follows: "Members shall confine limitations or exceptions to exclusive rights to certain special cases which do not conflict with a normal exploitation of the work and do not unreasonably prejudice the legitimate interests of the right holder." WTO Members are free to design copyright laws with broad or narrow exceptions as they choose, as long as they meet these conditions.

Hypothesis: Copyright Exceptions for Researchers Are Associated with Greater Research Output

Legal theorists have proposed that research exceptions can positively affect research output. Gowers (2006) posits that research exceptions "create greater scope for research on protected material by universities and business and expand the stock of knowledge." Reichman and Okediji (2012) argue that scientific researchers need laws that protect the unauthorized access of scientific data. However, there is very little *empirical* work on the subject, and to date there has been no paper that tests the relationship between copyright exceptions and researchers output.

The objective of my research paper will be to test whether scholars in countries where copyright exceptions allow researchers to access works more freely produce more output in the physical health fields. *My primary hypothesis is that copyright exceptions granting researchers in a given country more flexibility to obtain works without authorization will have a positive, significant effect on the quantity of scholarly works produced by scholars in that country.* This effect is expected to be stronger in countries with stronger copyright protection, and to be stronger in lower-income countries.

Previous Literature on Copyright and Copyright Exceptions

A small body of empirical work has shown relationships between the structure of copyright exceptions and various outcomes. Some papers address the link between copyright exceptions permitting datamining and research that relies on datamining, defined as machine-assisted analysis of large datasets. Datamining necessitates *copying* large quantities of content from original sources and therefore requires authorization from rightholders in many jurisdictions. However, some countries have specific exceptions for datamining, or have broad exceptions that permit the process without authorization. Handke, Guibault and Vallbé (2015) find that in "countries in which data mining for academic research requires the express consent of rights holders, data mining makes up a significantly lower share of total research output." Similarly, Filippov (2014) finds that the structure of copyright law in EU countries has reduced the number of published papers that utilize datamining techniques. Hargreaves et. al. (2014) use Filippov's data to find that the US and Canada produce more articles based on datamining than European countries that have more restrictive copyright limitations applicable to research.

Other papers have explored the link between copyright exceptions and ICT technologies (Lerner, 2014; Palmedo 2018), as well as the effect of copyright exceptions on commentary hardware industries (Ghafele and Friedman, 2014).

Though there is limited empirical work on copyright limitations, there is a broader empirical literature examining copyright's incentive for the creation of new works. Some researchers have studied the effects of copyright extension. Reichman (1996), Kuhne (2004), Ku, Sun and Fan, (2009) and Png and Wang (2009) find no evidence to suggest that copyright term extension led to more production of new works, yet Rappaport (1998) estimates that an extended copyright term would lead to $330 million in royalties and states that the net proceeds from the fee would be devoted to promoting the creative arts. Others have studied the effects of piracy on the creation of new works. Telang and Waldfogel (2014) find that high levels of piracy depress the production of new Bollywood films. Hollifield, Vlad, and Becker (2003) find that stronger copyright protection has been associated with the production of more print media. On the other hand, Waldfogel (2011) found that increased file sharing through Napster decreased the effectiveness of copyright for recorded music in the U.S., yet it led to no decrease in the creation of musical works. For a more comprehensive reviews of empirical copyright literature, see Handke (2011) and the Copyright Evidence Wiki (CREATe Centre, 2018).

2. Theoretical Model

This paper focuses on publications in the human health fields of study. It considers the scientific output of a field of study at the country level to be an accumulation of individual researchers' scientific output.

The production of a scientific paper is the output generated by the following inputs, all of which should have a positive association with the quantity of papers produced.

Labor by scientists, which occurs over a period of years. This includes the authors' research and writing, as well as the (generally unpaid) referees' reviews. If necessary, it can include translation work. It can include the labor of students, professors and even unaffiliated researchers.

Physical and financial capital. Physical capital includes laboratory equipment and computers. Financial capital is needed for publications fees, which are usually financed through a scholar's university or through external research funding. (Dallmeier-Tiessen, et al., 2011)

Access to "raw material" knowledge goods. These are the sets of raw information found in previously published scientific articles and books.

The current paper is most concerned with the last of these three. The model considers two factors that affect access to knowledge goods:

The Copyright Environment

A nation's copyright law will impact the accessibility of knowledge goods for researchers. All academic articles and books will likely be protected by copyright in any country that is a member of the WTO. If a country has more robust copyright limitations for researchers (including research institutions), then scholars may obtain works at a lower cost. With costs lower, they can produce more new knowledge works.

The importance of copyright limitations will be greater in countries with stronger copyright protection. Although every WTO Member will have copyright laws, the level of enforcement will vary from one country to the next. If copyright is more strictly enforced, then copyright limitations will have a greater impact on the level of access to previous works.

National Wealth

The level of national wealth will affect the ability of researchers and/or university libraries to afford knowledge goods. The literature cited above states (and common sense would suggest that) lack of access to publications is a more serious problem in in poorer countries. If research exceptions in copyright law ameliorate this problem, then the solution should have a greater impact in the South.

The final element in the model is time. The copyright environment and level of wealth that exist in a given period of time will affect the creation of scholarly output in future periods.

3. Econometric Model and Data

I use a production function for academic output at the national level, in which output is determined by Labor, Capital, and Information. The econometric model is:

$$Y_{c,s,t} = f(R_{c,t-\alpha}, X_{c,t-\alpha}, \tau_{c,s}, u)$$

Where $Y_{c,s,t}$ is the number of published articles and books by scholars (per capita) in country *c*, in subject area *s*, in year *t*. The variable $R_{c,t-\alpha}$ is a "research score" describing the strength of copyright exceptions for research in a particular country and year. It is based on an index of copyright exceptions that is described in more detail below. $X_{c,\, t-\alpha}$ is a vector of country-time specific controls. $\tau_{c,s}$ are subject-country fixed effects and *u* is the error term.

The subscripted term α indicates that these terms are lagged some number of years. There is no generally agreed-upon "average" length of time it takes to write a paper and have it published. One researcher has estimated the average time from submission to publication in the natural sciences is 125 days, but admits that there is a lot of variation, and that he did not have very complete data on which to base his assertion (Himmelstein, 2016). Given this uncertainty about the correct length of time to include in the model, I run panel regressions with various lags, and let the results guide me to a reasonable value for α.

Independent Variable of Interest

My independent variable of interest is an index of the strength of copyright exceptions for researchers, based on survey data from the American University law school. A brief explanation of the data source and the index derived from it follows. For a more complete description of the database and its construction, see Flynn and Palmedo (2018).

The American University Program on Information Justice and Intellectual Property (PIJIP) studies copyright exceptions. In 2013, we launched an interdisciplinary project involving empirical tests to see if structures of legal protections were associated with different outcomes for copyright stakeholders, but we found there was no available metric that would allow us to observe changes in copyright laws over time and across countries. In order to fill this gap, we undertook a survey project.

PIJIP surveyed law professors in different countries, asking numerous questions about their national laws on copyright exceptions, and how these have changed from 1970 to present. We defined "law" broadly to include legislated law as well as precedent-setting court cases and binding administrative rulings. Since this can lead to uncertainty as policies change over time via actions by different branches of government, we asked respondents for their "judgment on the degree of clarity in the law." Respondents answered each question on a four-point scale indicating that a certain action by users was "not included," "maybe/probably not included", "maybe/probably included", or "clearly included."

Our survey asked 132 highly technical questions to a small group of experts with specialized expertise. Each answer was accompanied by legal citations. Once we received their responses, AU law students checked the citations, and we re-contacted the respondents in cases where we could not verify their answer via the cite checking process. We then coded the answers on a 0-3 scale, with zero indicating a certain legal element was clearly not present in the country's law in a given year, and 3 indicating it clearly was present in the country's law.

To date, we have received, cite-checked and coded answers to the survey for 23 countries. For some of the countries, there is missing data in the earlier years, but we have data for each country from 2000 to present. 12 of the coded responses are from countries that are currently classified "high-income" by the World Bank, and the other 11 currently classified "middle income." Our set of countries is geographically diverse. Table 1 shows the countries for which we have data.

Table 1: Countries in Dataset

High Income	*Middle Income*
Australia	Argentina
Canada	Botswana
Chile	Brazil
Finland	China
Japan	Colombia
Korea	India
Netherlands	Peru
Poland	Slovakia
Portugal	South Africa
Singapore	Ukraine
Switzerland	Vietnam
USA	

The outcome of our survey process is what we call the PIJIP Copyright User Rights Database. It is the only data source we know of containing information on change in the fine details of copyright user rights over time in a broad set of economies around the world. We plan to add more countries over time, but we also believe we have enough data from a heterogeneous set of countries to begin empirical work using it.

To study the impact of copyright limitations on publishing output, I constructed a research score equal to the unweighted average of answers to 12 questions from the survey. These questions, listed in Table 2, are the survey questions that most directly relate to scholars' ability to access (without authorization) high priced academic articles and books. Throughout the rest of this paper, the variable *Research* refers to this index.

Table 2: Survey Questions Used to Construct Research Index

Respondents were asked to indicate the ranges of years from 1970 to present for which the answers to each question were "Clearly Included", "Mostly/ Probably Included", "Mostly Not/ Probably Not Included" or "Not Included":
Did your country's law contain a research exception?
Was your country's research exception open to the use of any type of work?
Was your country's research exception open to use by any type off user?
Was your country's research exception open to commercial uses?

Table 2: Survey Questions Used to Construct Research Index (Continued)

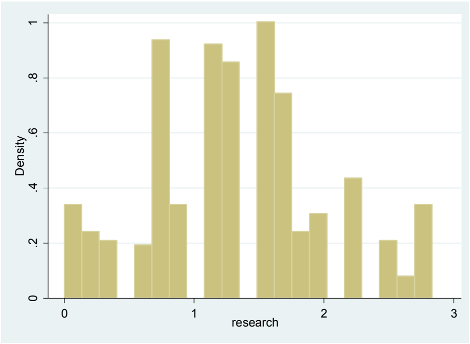
Did your country's law contain an educational use exception that can be used for any purpose?
Did your country's law contain an educational use exception that can be used by any use?
Did your country's law contain a library use exception that is open to any purpose?
Did your country's law contain a library use exception that is open to the making of copies of works for research by patrons?
Did your country's law contain a private use exception that is open to any purpose?
Did your country's law contain a private use exception that is available to any type of user?
Did your country's law contain a "general exception" that is open to any purpose?
Did your country's law contain a "general exception" that is open to any type of user?

Research has a normal distribution. Its summary statistics and histogram are shown below. For most of the countries, *Research* rises over the time period for which we have data, as countries have modernized their laws to include more robust limitations and exceptions.

Table 3: Summary statistics: Research Index

Mean	1.34
Median	1.33
Std. Dev.	0.69
Skewness	0.14
Minimum	0.00
Maximum	2.83
Observations	458

Figure 1: Histogram of Research Index



Dependent Variable

The dependent variable is the ratio of citable documents authored by researchers in a given country, year and scientific field, to the country's population. The data is disaggregated by field because conventions regarding co-authorship vary between them (Venkatraman, 2010).

I have two sources of data for published works. Each includes data on journal articles, books and conference proceedings authored by scholars at the country-subject-year level. I conduct the same tests on the citations data from each source, with the aim of finding parameters that can be reproduced in more than one set of data.

The first source of published works and citations is the SCImago Journal & Country Rank, which aggregates citations data from the Scopus database, published by Elsevier. It draws citation data from "over 21,500 titles from more than 5,000 international publishers and country performance metrics from 239 countries."[1] It provides results in 27 subject areas, and for each it reports the number of citable documents in a given year by authors in different countries.[2] To give an example of the level disaggregation, scientific subject areas include "Immunology and Microbiology" and "Neuroscience." This source has been used to measure publishing output in previous reports such as the Global Innovation Index, published by the World Intellectual Property Organization (Dutta, Lanvin , & Wunsch-Vincent, 2017).

The second source of published works is the Clarivate Web of Science, (until recently owned by Thomson Reuters and often referred to as the Thomson Reuters Web of Science). Its core collection includes over 18,000 journals from 3,300 publishers, and over 50,000 books.[3] This source was used by Handke, Guibault, & Vallbé in their datamining study, in which they described it as "a relatively comprehensive database of academic publications, which features items from thousands of journals with a strong international reputation and ranks among the most authoritative databases regarding academic publications]" (Handke, Guibault, & Vallbé, 2015). It has 155 subject areas – so the categorization is different from the Scopus dataset. Examples of its subject areas include "Immunology" as well as "Neurosciences & Neurology". Like the Scopus database, it enables one to find the number of papers or books written by authors from particular countries in each separate subject area.

Confronted with two datasets having information from 27 and 155 widely varied subject areas, I decide to focus on the subject areas related to the health/medicine sciences. Although the match of subject areas is approximate, I end up with two different sources of data on similar subjects. My subsample includes six subject areas in the Scopus database and eight in the Web of Science database. These subject areas are more cohesive than the full set of subject areas, and the literature reviewed above describes the problem of lack of access to journals focuses on these types of health-related fields. Table 4 presents the summary statistics for the quantity of citable documents produced at the subject-country level from both data sources.

1 http://scimagojr.com/aboutus.php

2 Note that the data is disaggregated by country of author – *not* by the country in which the journal is based.

3 https://clarivate.com/products/web-of-science/web-science-form/web-science-core-collection/

In both datasets, there is a positive association between *Research* and the number of papers produced in each subject area in each country. Separate scatterplots attached as Appendix 1 show that these relationships are noisy, but do not have any nonlinear properties that are obvious from casual observation.

Table 4a: Scopus Data on Quantity of Citable Documents:

Subject Area	Mean	St. Dev.	Skewness	N
Biochemistry, Generics and Molecular Biology	7178	15388	3.55	483
Chemistry	4843	9200	3.44	483
Immunology and Microbiology	1675	3395	3.66	483
Medicine	12558	28306	4.10	483
Neuroscience	1515	3599	4.07	471
Pharmacology, Toxicology and Pharmaceuticals	1856	3633	2.98	482

Table 4b: Web of Science Data on Quantity of Citable Documents:

Subject Area	Mean	St. Dev.	Skewness	N
Biochemistry & Molecular Biology	2048	5419	4.60	891
Biotechnology & Applied Microbiology	541	1246	4.09	858
Chemistry	3440	7797	3.86	911
Immunology	777	2054	4.66	862
Microbiology	895	2071	4.22	883
Neurosciences & Neurology	1676	4635	4.95	811
Pharmacology & Pharmacy	1134	2582	3.86	874
Toxicology	318	758	4.02	824

Control Variables

To control for the strength of copyright protection, I use a variable based on an index of copyright strength developed by Professor Walter Park and Tad Reynolds.[4] The index is

4 The index is available at http://fs2.american.edu/wgp/www/?_ga=2.33750561.1651042385.1528731157-1650226975.1521642567

comprised of twenty-one factors related to duration, usage, and enforcement of copyright, and membership in various copyright treaties. It covers the strength of copyright in 118 countries (not including the United States) from 1989 through 2011. On average, the countries' index scores tend to rise over time — a quality shared by my research score. In order to avoid problems related to multicollinearity, I order the countries from their highest mean copyright strength score to their lowest. Table 5 shows which countries had above average and below average copyright scores according to the Park-Reynolds index. I create a dummy variable, *StrongCopyright,* that is equal to one for the countries with above average copyright index value. In order to include the United States, I use information from the U.S. Chamber of Commerce Global Intellectual Property Index (Pugatch, Chu, & Torstensson, 2018) which ranks the U.S. as having the strongest copyright protection out of fifty countries in the study. Accordingly, *StrongCopyright* equals 1 for the observations from the U.S.

Table 5: Countries with Stronger and Weaker Copyright Protection.
Source: Park-Reynolds index of copyright strength

Countries with stronger protection of copyrighted works *StrongCopyright* = 1	**Countries with weaker protection of copyrighted works** *StrongCopyright* = 0
Australia	Argentina
Brazil	Botswana
Canada	Chile
Finland	China
Japan	Colombia
Korea	India
Netherlands	Poland
Peru	Slovakia
Portugal	South Africa
Singapore	Ukraine
Switzerland	Viet Nam
USA	

This dummy control for copyright strength will be used in some specifications of the following panel regressions in the form of an interaction variable *Research*StrongCopyright*, in order to test whether copyright limitations have a greater effect on research output in countries with stronger copyright laws.

I downloaded additional control variables from the World Bank's databank. The first is population, included as a proxy for the labor control in my hypothetical model. All else equal, countries with a higher population are expected to publish more works than small countries. (I had tried to find comprehensive data on the number of people in a given country/year with advanced degrees, or some other metric to better capture the number of people who might engage in academic publishing, but the available data was very incomplete, especially for the middle-income countries in the dataset.) GDP per capita in constant U.S. dollars is used as measurement of country wealth. In this econometric model, I assume that researchers in wealthier countries have more access to capital needed to conduct scientific research, so they will produce more papers. I also assume that libraries in wealthier countries will be more likely to have access to journals and other information resources.

In some of the regressions, I will interact GDP per capita with the research score. The coefficient on the interaction term is hypothesized to be negative, indicating that copyright limitations for research have a smaller impact in wealthier societies. Since wealthier societies tend to have stronger copyright protection than poorer ones, I do not include both *Research_StrongCopyright* and *Research_GDPp.c.* in the same regressions, but test them alongside each other.

4. Results

The main finding is that the coefficient on my research index (*Research*) is statistically significant and positive when tested in three specifications. Furthermore, the coefficients on *Research* are similar in magnitude when tested using both of the sources of data on scholarly output. This indicates a strong relationship between copyright exceptions for researchers in one period, and scholarly output in subsequent periods. The relationship is stronger when countries have stricter copyright laws, and is stronger when countries are relatively poorer.

The six columns in Table 6 report the results of three separate panel regressions run using both sources of citations data. The first three columns report the results using the Scopus dataset, and the second three columns report those using the Web of Science. In all regressions, the panels are at the subject-country level.

The regressions in Table 6 have been lagged two years. As noted above, there is little guidance for the best estimate of the average time from the start of writing a paper to publication. Therefore, I let the data guide me. I start by running regressions with a one-year lag and increase the lag by one year until the results begin to suffer. Based on the significance of the coefficients and the overall fit of the model, the one- and two-year lags provide the strongest econometric results. When the independent variables are lagged three or four years, the models become less robust. The coefficients on *Research* remain significant, but those on the interaction terms *Research*StrongCopyright* and *(Log) Research*GDPp.c.* lose significance. The two-year lag seems to yield the strongest results, and it aligns with Himmelstein's (2016) observation on time from submission to publishing. I therefore report the results of the regressions lagged two years in this paper. (The within-entity R^2s remain between 0.64 and 0.68 in all of the specifications, likely because the variation between panels is greater than the variation within them).

In Model 1, *Research* is included with controls for population and constant GDP per capita, but without either of the interaction variables. The coefficient is 0.22 for the Scopus dataset and 0.17 for the Web of Science dataset. In both cases, they are significant at the 99% level.

Table 6: Dependent Variable: Logged Citable Documents Per Capita Independent Variables Lagged Two Years

	(1)	(2)	(3)	(1)	(2)	(3)
	Scopus	Scopus	Scopus	WoS	WoS	WoS
Research	0.217***	0.144***	0.465***	0.169***	0.103*	0.450***
	(0.041)	(0.054)	(0.114)	(0.045)	(0.056)	(0.095)
Research*StrongCopyright		0.142*			0.159**	
		(0.085)			(0.080)	
(Log) Research*GDPp.c.			-0.248***			-0.265***
			(0.094)			(0.085)
(Log) GDPp.c.	2.037***	2.008***	2.251***	2.039***	2.033***	2.291***
	(0.108)	(0.109)	(0.118)	(0.083)	(0.083)	(0.100)
(Log) Population	0.704***	0.754***	0.720***	0.868***	0.829***	0.781***
	(0.170)	(0.184)	(0.194)	(0.125)	(0.133)	(0.139)
Constant	-42.40***	-43.07***	-42.73***	-46.22***	-45.55***	-44.95***
	(2.852)	(3.132)	(3.303)	(2.138)	(2.291)	(2.393)
N	2474	2360	2246	3265	3265	3113
Within-Entity R2	0.666	0.642	0.644	0.679	0.68	0.681

Table 6: Dependent Variable: Logged Citable Documents Per Capita Independent Variables Lagged Two Years (Continued)

	(1)	(2)	(3)	(1)	(2)	(3)
# of Sub-Country Groups	132	126	120	175	175	167

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Moreover, the overall model seems robust – the controls are positive and significant as expected, and the within-entity R^2 indicate a good overall fit.

I am hesitant to describe the quantitative effects of a qualitative variable, and it bears mentioning that a "one unit" increase in the research index represents a big legal change, since the index is on a four-point scale. Nonetheless, Model 1 implies that a one unit increase in the research index is associated with a 22% or 17% increase in the number of scholarly publications produced by researchers in a given country two years later, holding all else constant.

In Model 2, the interaction variable *Research*StrongCopyright* is added. Its coefficient is positive in the tests on both datasets. It is significant at the 90% level for the Scopus dataset and 95% for the Web of Science dataset. This suggests that copyright limitations have a larger impact on future scholarship in countries with stronger copyright laws. Conversely, limitations will have a weaker impact on future scholarship in countries where copyright is less protected – which is shown by the fall on the coefficient on *Research*. It is notable that the significance of the coefficient on Research drops to 90% when Model 2 is run on the Web of Science dataset, though the 99% significance level remains in the results from the Scopus dataset.

I add the interaction variable *(Log)Research*GDPp.c.* in Model 3. Its coefficient is negative and highly significant for the tests on both datasets, indicating that copyright limitations have less impact on a country's scholarly production as the country becomes wealthier. One could interpret this as an indication that copyright limitations for scholars have a larger impact on the publishing activity in the Global South.

Overall the econometric tests support the hypothesis that copyright exceptions for researchers are associated with greater publishing of scholarly works, that the effect is stronger when copyright protection is stronger, and that the exceptions matter more to researchers in less wealthy countries.

5. Robustness Tests

Research, as noted above, is an unweighted average of coded answers to 12 survey questions. In order to test the robustness of the metric in my econometric analysis, I adjust the weights randomly four times, and use these randomly weighted independent variables in series of panel regressions. In Robustness Tests 1 and 2, I adjust the weights randomly within 0.01 standard deviations of the mean weight (0.083), and in Tests 3 and 4, I adjust them randomly within 0.02 standard deviations. Tables 7(a-d) report the results (*ResearchRW* in these tables stands for "research – randomly weighted").

The coefficients on all of the randomly weighted research terms remain positive and statistically significant in each of the tests. The sizes of the coefficients on the weighted research terms are similar to those in Table 6 for the first and second specifications, thought they drop for the third specification.

Table7A:RobustnessTest-DependentVariable:LoggedCitableDocumentsPerCapita Independent Variables Lagged Two Years, RW(1) = *Research* Weighted by 0.01 S.D.

	(1)	(2)	(3)	(1)	(2)	(3)
	Scopus	Scopus	Scopus	WoS	WoS	WoS
ResearchRW(1)	0.217***	0.196***	0.330***	0.165***	0.133***	0.343***
	(0.041)	(0.042)	(0.097)	(0.038)	(0.040)	(0.084)
ResearchRW(1)*StrongCopyright		0.0922			0.135**	
		(0.074)			(0.068)	
(Log) Research*GDPp.c.			-0.0823			-0.129**
			(0.060)			(0.056)
(Log) GDPp.c.	2.039***	2.036***	2.127***	2.055***	2.052***	2.186***
	(0.108)	(0.108)	(0.117)	(0.081)	(0.082)	(0.093)
(Log) Population	0.708***	0.684***	0.674***	0.782***	0.749***	0.722***
	(0.169)	(0.177)	(0.184)	(0.123)	(0.130)	(0.134)
Constant	-42.46***	-42.08***	-42.10***	-44.83***	-44.29***	-44.05***
	(2.843)	(2.980)	(3.066)	(2.098)	(2.219)	(2.257)
N	2474	2474	2360	3413	3413	3261
Within-Entity R2	0.666	0.666	0.667	0.693	0.694	0.694
# of Sub-Country Groups	132	126	120	175	175	167

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table7B: Robustness Test - Dependent Variable: Logged Citable Documents Per Capita Independent Variables Lagged Two Years, RW(2) = *Research* Weighted by 0.01 S.D.

	(1) Scopus	(2) Scopus	(3) Scopus	(1) WoS	(2) WoS	(3) WoS
ResearchRW(2)	0.206***	0.181***	0.293***	0.154***	0.120***	0.301***
	-0.04	-0.0406	-0.0941	-0.0366	-0.039	-0.0832
ResearchRW(2)*StrongCopyright		0.114			0.152**	
		-0.0721			-0.0667	
(Log) ResearchRW(2)* GDPp.c.			-0.0636			-0.106*
			-0.0566			-0.0542
(Log) GDPp.c.	2.039***	2.037***	2.109***	2.057***	2.054***	2.166***
	-0.108	-0.108	-0.117	-0.0817	-0.0817	-0.0941
(Log) Population	0.707***	0.678***	0.678***	0.783***	0.745***	0.729***
	-0.17	-0.177	-0.183	-0.124	-0.13	-0.133
Constant	-42.45***	-41.99***	-42.15***	-44.85***	-44.25***	-44.15***
	-2.852	-2.99	-3.062	-2.105	-2.22	-2.25
N	2474	2474	2360	3413	3413	3261
Within-Entity R2	0.665	0.666	0.666	0.693	0.694	0.693
# of Sub-Country Groups	132	126	120	175	175	167

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table7C: Robustness Test - Dependent Variable: Logged Citable Documents Per Capita Independent Variables Lagged Two Years, RW(3) = *Research* Weighted by 0.02 S.D.

	(1) Scopus	(2) Scopus	(3) Scopus	(1) WoS	(2) WoS	(3) WoS
ResearchRW(3)	0.210***	0.190***	0.298***	0.158***	0.127***	0.310***
	(0.041)	(0.042)	(0.092)	(0.038)	(0.040)	(0.082)
ResearchRW(3)*StrongCopyright		0.0807			0.122*	
		(0.075)			(0.070)	
(Log) ResearchRW(3)* GDPp.c.			-0.0668			-0.114**
			(0.057)			(0.055)
(Log) GDPp.c.	2.043***	2.042***	2.117***	2.060***	2.058***	2.176***
	(0.107)	(0.107)	(0.117)	(0.081)	(0.081)	(0.093)

Table 7C: Robustness Test - Dependent Variable: Logged Citable Documents Per Capita Independent Variables Lagged Two Years, RW(3) = *Research* Weighted by 0.02 S.D. (Continued)

	(1) Scopus	(2) Scopus	(3) Scopus	(1) WoS	(2) WoS	(3) WoS
(Log) Population	0.705***	0.685***	0.675***	0.781***	0.750***	0.725***
	(0.170)	(0.178)	(0.184)	(0.124)	(0.132)	(0.135)
Constant	-42.47***	-42.14***	-42.14***	-44.85***	-44.36***	-44.11***
	(2.860)	(2.999)	(3.077)	(2.112)	(2.237)	(2.268)
N	2474	2474	2360	3413	3413	3261
Within-Entity R2	0.665	0.665	0.666	0.693	0.694	0.693
# of Sub-Country Groups	132	126	120	175	175	167

Robust standard errors in parentheses
*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 7D: Robustness Test - Dependent Variable: Logged Citable Documents Per Capita Independent Variables Lagged Two Years, RW(4) = *Research* Weighted by 0.02 S.D.

	(1) Scopus	(2) Scopus	(3) Scopus	(1) WoS	(2) WoS	(3) WoS
ResearchRW(4)	0.191***	0.173***	0.307***	0.141***	0.115***	0.317***
	(0.039)	(0.039)	(0.112)	(0.036)	(0.037)	(0.097)
ResearchRW(4)*StrongCopyright		0.0911			0.129*	
		(0.083)			(0.076)	
(Log) ResearchRW(4)* GDPp.c.			-0.0791			-0.119**
			(0.065)			(0.060)
(Log) GDPp.c.	2.046***	2.043***	2.130***	2.064***	2.059***	2.181***
	(0.108)	(0.108)	(0.117)	(0.082)	(0.082)	(0.094)
(Log) Population	0.716***	0.694***	0.679***	0.790***	0.759***	0.727***
	(0.169)	(0.177)	(0.186)	(0.124)	(0.131)	(0.136)
Constant	-42.68***	-42.31***	-42.24***	-45.03***	-44.51***	-44.16***
	(2.828)	(2.977)	(3.095)	(2.094)	(2.217)	(2.285)
N	2474	2474	2360	3413	3413	3261

Table 7D: Robustness Test - Dependent Variable: Logged Citable Documents Per Capita Independent Variables Lagged Two Years, RW(4) = *Research* Weighted by 0.02 S.D. (Continued)

	(1) Scopus	(2) Scopus	(3) Scopus	(1) WoS	(2) WoS	(3) WoS
Within-Entity R2	0.664	0.664	0.665	0.692	0.693	0.693
# of Sub-Country Groups	132	126	120	175	175	167

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

In the robustness tests using the second specification and the Scopus dataset, none of the coefficients on the interaction terms combining the weighted research score and the copyright strength dummy are significant. (In the original tests, the coefficient on this term had only been significant at the 90% level). However, the corresponding coefficients in the tests on Web of Science data are positive and significant at the 95% level Robustness Tests 1 and 2. Their significance falls to 90% as the range of the random weights increases in robustness tests 3 and 4. The coefficients on the interaction terms combining the weighted research variables and GDP per capita are also insignificant when the robustness tests use the Scopus dataset. They are negative and significant as expected when the robustness tests use the Web of Science dataset.

Finally, I test the robustness using a subset of the research score – the unweighted average of the coded answers to the four questions that relate directly to the inclusion of a copyright exception for research in a country's law. These are the first four questions listed in Table 2.

The results (not shown) are inconclusive. In the absence of interaction variables, the coefficients on the new research variable are positive and significant, though smaller in magnitude than the coefficients in the original model. However, the interaction variable for copyright strength enters with a negative coefficient. Furthermore, in the third specification both the research term and the interaction variable with GDP per capita are insignificant.

A possible explanation for these confusing results is legal, rather than economic: countries craft their laws differently. Research exceptions may be found in a section of one country's copyright law clearly identified as "Limitations for Research", but in a different section of the copyright law in another country. This is why the variable *Research* developed for this paper's econometric tests tried to capture the most useful provisions for researchers seeking unauthorized access to copyrighted works within five types of copyright exceptions.

Overall, the robustness tests support the finding that there was a positive association between strength of copyright limitations for researchers and the quantity of scholarly output produced in subsequent years. Robustness tests using the Web of Science data supported the suggestions that copyright limitations matter more in countries with stronger copyright protection, and matter less in wealthier countries. However, robustness tests using the Scopus data did not support the specifications with interactions.

6. Conclusion

Copyright law incentivizes the creation of new works, but it does so by limiting access to existing works to those who cannot afford it. In the modern world of academic publishing, high book and journal prices present barriers to researchers who wish to build on previous knowledge. One possible solution to this problem is for countries to broaden copyright exceptions that allow scholars to access works for the purpose of conducting further research.

This paper has demonstrated that scientists residing in countries which have implemented more robust copyright exceptions for research published approximately 17-22% more papers and books in subsequent years. It has found some evidence that the effect is greater in countries where copyright protection of existing works is stronger, and that the effect is greater in poorer countries, though the evidence regarding these interactions is less robust.

It also leaves ample room for further study. The sample of countries studied is small, so it would be good to test the model on a larger set. The issue of paper *quality* has not been addressed – it would be interesting to see if a relationship between the structure of copyright laws and paper quality exists, and citations metrics such as the H index could tested with the *Research* variable applied above. Finally, the law "on the books" and "on the ground" may be different, leading to outcomes that do not neatly align with theory. A set of empirical tests of copyright policy that capture the difference between what researchers are allowed to do, and what they do in practice, might yield different results.

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