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# Are the best tunes played on the oldest fiddles? Distribution and digitization of recorded classical music *

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**Abstract**

This research looks at the distributional effects of copyright when creative works are protected under multiple rights. It exploits a quasi-natural experiment and recent law changes introduced under EU Directive 77/2011 on the term of protection of copyright and related rights as well as variation in author death years. We examine the causal implications of copyright and related rights protection around music recordings vis-à-vis public domain status for the availability of classical music as physical and digital releases. Results suggest that public domain status of related rights favours the availability and re-releases of classical music in physical and digital formats. The emergence of music streaming services in EU member states and catalogue-wide licensing moderate effects over time. We however find little evidence that public domain status of author rights affects the distribution of classical music in digital or physical channels. We contemplate the implications of our results for intellectual property policy.

**Keywords:** Copyright, Related Rights, Music, Distribution.

**JEL Codes:** K11, O34, O38.

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# 1 Introduction

Debates on copyrights (and related rights) often focus on their role as incentives to create copyright-able works. A copyright grants temporary market power and control over the availability and prices of creative works giving the copyright holder a unique opportunity to profit from that work and thus incentives the creation of new works (Giorcelli and Moser [2020]). However once works are created, incentives to create are no longer as important as the availability of already created works and incentives to distribute works. On one hand, proponents of longer copyright terms argue that copyright protection prevents the tragedy of the commons wherein having no protector, creative works in the public domain may not receive adequate promotion. On the other hand, skeptics insist that everlasting terms raise the costs of availability and reuse of important cultural works for future generations, long after the creator of a work is dead (Hirtle [2008], Buccafusco and Heald [2013], Heald [2014b, 2019]). In this paper we provide empirical evidence of the implications of copyright protection for the availability and distribution of classical music.

Our arguments are based primarily on analyses of over 7,300 recording releases of classical music using *difference-in-differences* and quasi-natural experiment models that leverage unique attributes of EU copyright law changes and staggered adoption in EU member states (via the subsequent 'national implementation' of such laws). Our results in conjunction with extant literature, inform the fundamental premise of this article: that both copyright protection and copyright term limits are crucial to supporting creativity and the distribution of works. Specifically, we find that the lapsing from protected status (with respect to recording rights) to the public domain positively impacts the physical re-release of classical music recordings, with a range of 11% to 58% depending on the model specification. Moreover, we find a positive impact of recording rights public domain status on digital release. With respect to author rights and based on the random variation in author death years, public domain status shows little to zero effect on music availability. These findings are based on data from WorldCat's catalogue of classical music recordings made between 1902 and 2018 in the European Union. WorldCat is a database of global

library holdings of music and other media content.

By studying the differences in availability of works in and out of copyright protection, we accomplish three objectives. First we shed light on some of the distributional effects of copyright policies, as they exist. Second, we are able to, for the first time, separate the effects of recording rights from those of author rights. Third we distinguish the aforementioned effects on physical vis-à-vis digital releases as in MacGarvie et al. [2021].[1] Altogether, this paper provides economic insights into the ease of on/offline rights clearance, potentially higher costs from multiple rights transactions, and legal uncertainty around the use of rights in older works, as future uses such as digital distribution were not always covered in the early rights contracts signed by composers, performers and record labels.

The rest of the paper proceeds as follows. Section 2 introduces the literature review. Section 3 discusses the analytical framework. Section 4 describes the data, and Section 5 lays out the empirical strategy. Section 6 presents the main results, and robustness analyses. Section 7 discusses limitations of the approach and policy implications. Lastly, Section 8 concludes.

# 2 Prior literature

Evidence from the extant literature on the relationship between copyright status and availability of works is mixed. For instance, copyright and public domain status appears to affect works differently depending on how they are distributed. As an example, copyright expiry has been shown to increase the supply of songs in physical distribution channels, while decreasing its availability as performed in live concerts and making little difference to its availability on digital platforms (MacGarvie et al. [2021]). In addition, the type of

[1] As compared to MacGarvie et al. [2021] and their musicbrainz data, our library data is also representative of the universe of classical music recordings released in EU member states for this music genre, while we do not cover right status effects on live performances in this paper but elsewhere (Cuntz [2022]). Moreover, for digital releases and compared to their Spotify/Amazon data, our data is likely less biased by the curation of online services and different platform designs bringing classical music and operatic works to music consumers (Edelman et al. [2017]).

work matters. Reimers [2019] examines the implications of the 1998 copyright extension act in the United States and finds that copyright protection significantly decreases the availability of books; while on the other hand Buccafusco and Heald [2013] find no evidence that copyright term extensions improve the availability of audiobooks in terms of both quality and quantity.

Unlike books, a piece of recorded music may be covered by multiple rights, namely composer rights, performer rights, as well as production and lyricist rights. Thus a piece of recorded music may be said to be in the public domain in terms of the composition (composer or author rights) such that anyone can freely re-record that music, but may only use the recording with respect to the rights of the performer. However, because the data used in previous studies do not allow them to distinguish the implications of copyright status for different rights, these prior studies of the availability of music have not been able to distinguish these rights empirically. In this work, we consider how copyright protection affects the availability of music distinguishing composer and performer rights. Specifically, we show that the type of right that lapses seems to matter for music re-release and for the digital distribution of previously released music. By doing so we contribute to the growing literature on the economics of digitization, the economics of music copyright and related debates on the development of copyright policy.

In the following section we will provide a background to copyright and related rights in the European Union which is the context of this study, and then we will elaborate on the concept of music availability in terms of physical and digital releases.

# 3 Background

## 3.1 Music recordings and author rights in the European Union

In Europe, the power to grant and regulate copyright and related rights has traditionally rested with national governments. However in 1993, the then European Economic Community made the first attempt to harmonize these rights amongst member states

including the rights of authors, performers and producers of related works. This directive has subsequently been revised, notably in 2001 and 2006, leading up to the most recent amendment in 2011.

EU law recognizes three categories of right holders for musical works: authors (defined in the 2011 amendment as lyricists and musical composers); performers; and producers. Music publishers typically control the copyright and distribution of a composition on behalf of authors, while producer rights are typically held by the record label. In practice, the big 3 music publishers - Sony, Universal and Warner - also own their own record labels. Copyright protection for authors in the EU has been harmonized across member states at 70 years after the death of the last surviving author since 1993. This right covers the words, i.e., the lyrics of the song, typically owned by the lyricist; as well as the musical composition, typically owned by the composer. On the other hand, related rights protection for performers, which was previously set at 50 years from communication or publication in 1993, has now been set to 70 years since 2011, term extensions also applying 'retroactively' to rights created in the past and works still protected at the time of the reform. Related rights protection for producers was similarly increased from 50 years set out in 1993 to 70 years from the date of publication or failing that, communication, as set out in 2011. Performance rights may be understood to cover the vocalizations in the musical recording, while producer rights may be understood to cover a specific recording and copies thereupon. The rationale given for these term extensions was to ensure that performers continue to receive revenue from their works for the duration of their lifetimes and thus avoid a situation where performers face an income gap in their later years of life. Moreover, term extensions were expected to enhance the competitiveness of the EU music industry, and increase the available music repertoire (Commission et al. [2008]).[2] It is important to note however that these EU directives are implemented in slightly different ways and at different times in member states.

[2]Regarding performers, the Commission also considered that certain mechanisms were required to strengthen performer positions in contracts with phonogram producers. In what concerns producers, the Commission noted their decreasing revenues and their disadvantage vis-à-vis their US counterparts (Commission et al. [2008]).

Despite the distinction of these rights, it is common, for example, for an author to also perform and perhaps even produce a musical work such that multiple rights may be held by the same person. In classical music, where many of the authors of currently popular works are long dead, it is somewhat more common for the author, performer and producer rights to be held by different people. In most cases, performers will transfer their rights to the recording label, with only a few top performers being in a stronger position to keep and bargain their rights and related royalties from the recording. Nonetheless, a record label wishing to make a music record available to the public such as through (re-)releasing the record or digitizing a previously physical work must first clear all three rights or ensure that the record is in public domain with respect to all three rights. In the subsections that follow, we will discuss the availability of music in terms of physical re-releases and digitization and examine how changes in copyright and related rights statuses on one hand, might affect the availability of classical music recordings on the other hand.

## 3.2 Classical music reuse

Unlike most other creative sectors where commercial activity centers around works that are still under copyright protection (Heald [2014a], García et al. [2020]), classical music and opera in particular is special because it relies greatly on performances of a body of works known as the 'operatic canon'. Most of these works (compositions) are in the public domain as composer rights have expired. Since these works continue to have commercial value for audiences today, it is not uncommon, for example, to find new (re-)releases or recordings of works by opera composer Richard Wagner (1813 – 1883) who has been dead for more than the 70 years post mortem protection typically granted to authors. In this case, while the performance may be protected by related rights, the underlying composition and lyrics by Wagner are already in the public domain as author rights have expired. At the same time, contemporary and prominent composers such as Sergei Prokofiev (1891 – 1953) whose operatic works continue to be protected are being performed, recorded and (re-)released. This unique context allows us to for the first time, distinguish the effects of music author copyright from related rights for performers and record labels on the availability of recorded music. We are thus able to extend the

approach focused on recording rights alone developed in MacGarvie et al. [2021]. This is our main contribution to the literature.

### 3.2.1 Physical releases of music

The physical availability of creative works has often been measured by observing how often that work has been re-released (Heald [2014b], Reimers [2019], MacGarvie et al. [2021]). A re-release is the reissue of a music recording which has been previously released. The decision to re-release a music recording is typically taken by a record label. Music may be re-released to accommodate new audio formats, as a result of new ownership, to commemorate special events or achievements, to revise the recording (e.g., due to controversy - such as deleting a controversial song from an album) or as a strategy to increase sales. During recording rights protection, a record label typically exercises exclusive rights to a music record, including the right to re-release music in their catalogue. Once a work of recorded music is in the public domain however, anyone can re-release this music. In fact, so called 're-issue labels', record labels that specialize in re-releasing records are common (MacGarvie et al. [2021]). Lacking the assets of major record labels, these re-issue labels pursue a commercial strategy re-releasing music in the public domain for which rights clearance is not needed and hence transaction costs are avoided.

We distinguish a re-release from a re-recording and a remaster. A re-recording is a new record often based on a note-for-note replication of a music recording by the original performer. Re-recordings are often done to bypass previous record deals and give the performer greater control of the rights and emoluments from the new recording. Furthermore, although a remastering can prompt a re-release, the term re-mastering refers to the process of making a new master record (one from which other copies are copied) by making slight engineering alterations to the original master recording, usually with the goal of producing an improved listening experience. While re-recordings often generate new related rights since they are essentially new performances that undergo a new fixation process, whether a remastering generates new rights is unclear from a legal standpoint

and depends on the specific jurisdiction. In this paper, we will examine and limit to the physical availability of music through re-releases which are copies of the same master record of an original release, excluding cases of re-recordings and remasters from the scope of our research.

### 3.2.2 Digital releases of music

Unlike more popular genres of music, where digitization is being spearheaded by streaming services such as Spotify and other major rival streaming services, this is not clearly the case for opera music and classical music in general. In Britain for example, streaming accounts for just over 25% of classical music consumption compared to over 63% for music as a whole.[3] This lower representation of classical music on the major streaming services may be due to a number of factors. First, large music streaming services such as Spotify and other digital streaming platforms (DSPs), and their built-in functionalities are not designed for the search and discovery of classical music. For instance it is often not enough to search by song title and author, rather classical music listeners often need to specify a conductor, orchestra or performer to adequately identify a record, and doing so is not straightforward or even possible on many of the largest DSPs. Second, as DSPs often pay *per stream*, streaming's limited financial incentives to upload are heavily skewed towards shorter pop music pieces, to the detriment of longer classical music titles.[4] Similarly, prior legal research has described the high transaction cost and complexity of operating in the licensing environment for digital uses in the EU and U.S. (Schwemer [2014], Priest [2021]). For example, because available licenses for each right are either collectively or individually managed and relative transaction cost may differ by the type of right involved, multi-territorial and multi-repertoire licensing becomes more difficult for new DSPs (Ranaivoson [2012]).[5]

[3]According to British Phonographic Industry, a trade body whose members account for 85% of music sales in Britain (https://www.bpi.co.uk/news-analysis/classical-crescendo-for-music-sales-streams-in-2018/).

[4]For example, see the discussion here.

[5]The European Commission in its 2012 Impact Assessment described the situation as being 'characterised by a high number of licensors, limited access to multi-territorial licenses, high transaction costs and a low level of legal certainty' (Commission et al. [2008]). A separate empirical investigation of the effect of right status on the digital availability of classical music recordings on streaming platforms is required.

Notwithstanding these considerations, digital releases and digitization of classical music continue, driven by specialised DSPs such as Naxos or Primephonic and through the activities of cultural memory institutions such as libraries which digitize classical music to make available to their patrons. This has implications for the present study. Large DSPs tend to benefit from strong network effects such that consumers are attracted to DSPs with more music offerings and this in turn strengthens the position of the DSP in the market. As a result, rather than negotiate individual deals for songs or albums, DSPs have tended to negotiate with record labels for rights to their entire catalogues of music.[6] In this context, for music belonging to such negotiated catalogues the copyright status of an individual music record may seem to matter less for the availability of that music. This may not be the case with the smaller specialised DSPs and other institutions that produce digital releases of classical music. Furthermore, many older music rights contracts did not include terms about digital use, and such terms can be difficult to renegotiate and generate transaction costs to stakeholders. In Europe for example, although international collaborations between collection societies have been created to facilitate multi-territorial licensing of digital music rights, many music recordings still need to be licensed on a territory-by-territory basis (Towse [2013, 2017]).

In our analyses, we examine the availability of music in both physical and digital channels, using an unique dataset that is representative of the universe of releases of classical music and opera recordings in particular.

[6]Nonetheless, as long as a work is not in public domain, several issues can restrict their availability on DSPs. First, musicians may resist digitization of their music for personal reasons; for example, in 2015 popular British singer Adele initially withheld her new album from streaming services such as Spotify and Apple Music citing her disapproval of streaming because "it's a bit disposable" (Time Magazine interview with Adele, 2015). Furthermore, the record label holding the rights to a recording may be defunct or untraceable, making such records orphan works that are impossible to license for digital use (Varian [2006]).

# 4 Data

To investigate the effect of the public domain status on the re-release of opera recordings, we use detailed data on music recording publications across European Union jurisdictions. The data are provided by WorldCat, the world's largest bibliographic database consisting of references to over 3 billion physical and digital assets held in a network of tens of thousands of academic and public libraries located in 107 countries.

The database consists of yearly opera recording publications, at recording level, from the year 2000 to 2018.[7] Hence, we construct a balanced panel in which the unit of observation is the opera recording-year at publication country level. Moreover, we generate our main dependent variables as the counter of the yearly re-release of classical music and opera recordings in particular.

## 4.1 Data validation

To better understand our data, we conducted a series of interviews of senior managers at the largest libraries in Austria, France, Germany, Italy, Switzerland and the UK. These interviews allowed us to understand the incentives and processes of collecting opera music and reporting such holdings on WorldCat. At large, given the large number of libraries contributing to WorldCat, we are confident the data does not suffer from any curation or other significant biases.[8] Interviews delivered two main insights relevant to our analyses. First, that in their role as legal deposits and primary work repository in a country, in some cases, larger (national) libraries can be legally required to collect all materials published

[7]The initial database also includes the year 2019; however, since the subscribing member libraries collectively maintain and update the WorldCat's database, at the time of data collection, the year 2019 suffered from missing observations. To avoid biased estimates, we drop the year 2019 from the sample.

[8]Libraries have purchase processes and rules that are unique to them but in general, purchases tend to reflect a combination of demand and cultural promotion. However, we do not believe that possible curation bias is an issue for two reasons. First, since our interest in this study is in observing whether a work is re-released or digitized, and not in estimating sales volumes, a physical or digital release merely has to exist in at least one library in the sample for it to be accounted for. Works that have received significant promotion are merely shown to exist in our analyses, whereas works that may have been suppressed would have had to be eliminated or barred from every single library we observe – a herculean endeavor to say the least. Second, given the breadth of our sample, we expect that our data reflects a wide enough range of library collections that individual collection manager biases ultimately cancel out each other.

in a given territory (van Gompel and Massalina [2021]). This provides institutions with a strong incentive to come up with a representative collection of titles which enter the WorldCat data. Moreover, as cultural memory institutions and as a source of scholarly information, some (specialized) libraries might engage in the digitization of musical works themselves, including the digitization of rare and more niche titles in catalogues.[9] Even when access to such digital works may not be granted or use is restricted to library premises, works in these so-called "dark archives" are reported in our WorldCat data. Furthermore, libraries may also purchase digital music from commercial streaming services to make available to their users. One of the most popular of these is Naxos, which claims to be the largest streaming service for classical music in the world, and which counts libraries as its largest and most important customer segment. Music from Naxos is also listed on WorldCat.

Secondly, respondents revealed two main incentives for reporting their collections on WorldCat, namely: (1) WorldCat is a means of advertising their collections to the public; and (2) WorldCat is also used internally by these libraries as a means of digitally cataloguing their own collections.

Thus using WorldCat data gives us a rather complete view of works of opera recordings, including many rare or unique works from all over Europe. We also note that WorldCat data has been used in previous studies on the relationship between copyright and the availability of works (Heald [2019]) and the availability of music in particular (Heald [2014b]).

## 4.2 Covariates

We created covariates using the information provided in the initial dataset by WorldCat. First, to account for classical music and opera recording re-release in particular, because of composers' anniversaries, we generate indicator variables for each $25^{th}$ death or birth anniversary of opera composers. Second, we code an indicator variable that accounts for

[9] In addition, digitization efforts also allow libraries to protect and preserve fragile physical copies from wear by allowing them to keep these unique physical copies from public access.

opera recorded in the same language as in the release country. This covariate accounts for specific market preferences in opera re-releases. Next, we generate a dummy variable for original live recordings. Third, we generate a dummy variable to control for recordings that were made by the most popular orchestras, conductors or performers.[10] Next, we generate a dummy variable that accounts for the public domain status of the opera composition at the recording year.[11] Lastly, we create a variable that accounts for the number of contributors per recording.[12]

We have further generated variables to account for the birth and death years of opera composers, the premiere dates of opera compositions, as well as composer death during World War I or II as these composers are sometimes treated differently in jurisdictions.[13] In these cases, we have sourced the relevant fields from Operabase and Loewenberg [1978] as well as wikipedia and other online sources used in the authors' companion paper (Cuntz [2022]).

In the following sections we discuss our empirical strategies for identifying the effects of copyright and related rights and describe the relevant outcome and treatment variables.

[10]Further detail in the Online Appendix.

[11]To generate this variable, we inspected the different historical legal rules and terms of protection in the countries and jurisdictions considered in this research.

[12]The number of contributors refers to the number of individuals who participated in the recording, such as the conductors, the musicians, the performers and the opera composers who performed during the recording (if applicable). This is a proxy of total contributors as opera often involves many contributors and some operas are more complex to stage than others because they demand more principal and specialized singers, larger chorus, complex sets, or a large orchestra such as Verdi's opera Aida and Puccini's Turandot. So, ultimately, the proxy also relies on the individual librarian and his or her efforts to provide details on all or only some (non-)featured performers listed on the recording, e.g. opera singers, conductors, soloists, orchestra etc. The same applies to the record label manager when first deciding what information to supply on the specific recording.

[13]In our research, we attempt to fully account for all specific wartime rules as laid out in specific national laws (e.g. France, Italy, or Belgium) and, eventually, longer terms of protection granted to composer dying in World Wars I and II. As these national rules are often complex and difficult to implement in the data (Angelopoulos [2012]), we include a control variable to models to address possible imperfections in data coding.

# 5 Empirical Strategy

## 5.1 Recording rights

In order to investigate the impact of the public domain status on the re-release of classical music and opera recordings in particular, we implement a generalized *difference-in-differences* (*DiD*) strategy. Given the public domain transitioning of an opera recording released 50 years before the EU Directive, our main hypothesis is that the recordings entering the public domain are more likely to be re-released than copyrighted ones. To test this conjecture, we adopt an identification strategy that allows us compare re-releases of opera recordings lapsing into the public domain given the retroactive 20-year jump in copyright status introduced by the EU Directive's adoption. The timeline outlined in figure 1 illustrates the research design. Hence, we estimate the following two-way fixed effects model:

$$y_{r,c,s,t} = \alpha_s + \gamma_t + \beta \, Public\,Domain_{r,c,s,t} + X_{r,c,s,t} + \epsilon_{r,c,s,t} \tag{1}$$

where $y_{r,c,s,t}$ is the count of the physical re-releases of recording $r$ of composer $c$ in member state $s$ and year $t$, $Public\,Domain_{r,c,s,t}$ is a dummy variable that is equal to 1 if the opera recording copyright in EU member state $s$ at year $t$ has expired. $X_{r,c,s,t}$ is a matrix of time-varying controls.

In our observational data, recording rights naturally end after a statutory duration. In such a setting, a song's popularity and age might be correlated as shown in previous research on pop music (Waldfogel [2012]). Moreover, it is important to control for the shift in the music industry towards more digital distribution in the observation period as demand for physical re-releases was likely declining relative to digital distribution. Both aspects might confound an analysis of the effects of public domain status. Accordingly, our DiD strategy exploits variation introduced by copyright term extensions implemented in member states. This allows us to separate the effect of right status from shifts in demand as recordings grow older as well as plausible anniversary effects leading to an increase in

commemorative re-releases precisely 50 years after the original (first) recording release. Absent the term extension, right status in our sample would be perfectly predicted by recordings aging past 50 years. Whereas all recordings in our panel below 50 years of age are protected under recording copyright, this extension provides a sample of counterfactual recordings that are greater than 50 years old and in the public domain as well as recordings of the *same* age that are still protected under recording rights. Ultimately, this allows us to estimate the counterfactual of availability under longer copyright terms and further justifies our empirical design.

Importantly, as our dependent variable is a counter of the physical re-release, we adopt a Poisson pseudo-maximum likelihood model with multi-way fixed effects (Correia et al. [2020]). Concerning digital re-releases, our data shows that multiple releases are extremely rare.[14] We interpret this descriptive as the digitizing process of a physical recording - in other words, after the first digitization of the physical recording, there is little incentive to digitally re-release the same record.[15] For this reason we generate a dependent variable which is a dummy in case of digital release, and zero otherwise. Thus, the dependent variable may also be cautiously interpreted as a proxy for the digitization of the physical recording. Given the binary nature of the dependent variable, we adopt a specification similar to the model 1, but with a linear regression with multi-way fixed effect specification.

## 5.2 Author rights

To observe the effect of author rights (in the absence of recording rights), we focus here on records that are already in public domain with respect to recording rights and develop a separate empirical strategy based on random variation in author death years. We provide a summary of these observations for digital releases in Table 24 and physical releases in Table 25. This permits a study of author rights in the absence of recording rights.

[14]Specifically, we observe only two recordings that are digitally re-released four times in Europe.

[15]Given time window data constraint (from 2000 to 2018), we cannot directly test if a recording was digitally transformed before the beginning of our data time period.

In the ideal experiment, we would randomly assign compositions into one of two groups. The treatment group would be granted copyright protection for the period of observation, whereas the control group would receive no copyright protection during the period of observation. The difference in availability between the treatment and the control groups could then be said to be the causal effect of author rights in the absence of recording rights.

Here, this other empirical strategy exploits the fact that in the EU, the term of author rights protection depends on the life span of the author. We assume that the precise year of death for composers is randomly distributed, unpredictable and did not affect the nature of the composition created while the author was alive, even though, at large, death correlates with age. As such, in a given period of observation, we have a natural experiment where compositions created around the same time are randomly assigned (based on author lifespan) to the treated group - being under copyright protection - or the control group - being in public domain with respect to author rights. Again, it is important to consider compositions created around the same period, as composition age likely correlates with unobservable composition popularity (Waldfogel [2012]). The illustrative timelines of two hypothetical compositions are shown in figure 2. The treatment effect is thus the difference between the means of the two groups in terms of number of recordings. In practice, we also observe a third group, those compositions for which their author rights transitioned from protected status to public domain during our period of observation (2000 - 2018). Summary statistics for all three groups are provided in Tables 26 and 27.

Unlike previous studies, our work is uniquely positioned to exploit this quasi-natural experiment for two reasons. First, previous studies of the effect of copyright on music availability have often focused on pop music (MacGarvie et al. [2021]). Unlike pop, where audiences tend to overwhelmingly favour more recent music, in classical music and opera in particular, audiences tend to favour compositions made decades and even centuries ago. Thus while older pop music may have limited circulation, with classical music, we are able to observe compositions that are old enough for both recording and author rights to have lapsed, but which are still circulated in large enough quantities in the digital age to be

subject to analyses. Second, previous studies of author rights in general have focused on the US context (Reimers [2019]) where the first set of works protected under terms that depend on the life of the author are just (in 2019) coming into public domain. Previously, U.S. law protected musical compositions for a fixed duration from the date of creation regardless of the lifespan on the author.

It is important to note that the time between random assignment (author death) and treatment (public domain status) is long (70 years). As a result, stakeholders including music publishers and record labels, have considerable time to strategize and act to mitigate or accentuate the effect of the random assignment. For example, some record labels might increasingly release music shortly before the expiry of the term, thereby avoiding tighter competition and lower prices after public domain entry. Our empirical strategy cannot completely disentangle such anticipation effects from true causal effects. Still, such a downward bias might work in our favor as camouflaging true estimates that are potentially higher. Moreover, on one hand, the expiry of copyright protection eliminates the exclusive right to the work regardless of any anticipation effects, and we continue to expect that with such rights gone, incentives to make said work available decrease for the erstwhile right holder. On the other hand, the authors are not aware of any EU-wide strategy that prior copyright holders have successfully used to block reissues of music in the public domain. Hence from this perspective, we also do not expect anticipation effects to completely diminish incentives of third parties to reissue and, if anything, expect this to downward bias estimates.

Formally, we model the effect of author rights as:

$$y_{r,c,s,t} = \alpha_s + \gamma_t + \beta \, \textit{Public Domain Status}_{r,c,s} + X_{r,c,s,t} + \epsilon_{r,c,s,t}$$

where: $y_{r,c,s,t}$ is one (1) if a physical or digital release of composition $r$ (related to the opera composer $c$) in a EU member state $s$ and year $t$ is observed, and zero (0) otherwise; $\textit{Public Domain Status}_{r,c,s}$ is a categorical variable that is equal to zero (0) if

opera composition $r$ (related to the opera-composer $c$) in EU member state $s$ is in the public domain throughout the period of observation (2000 - 2018), it is equal to one (1) if the composition is under copyright throughout the period of observation, and it is equal to two (2) if the composition is under copyright at the start of the observation period (2000) but transitions to public domain before the end of the observation period (2018); $X_{r,c,s,t}$ is a matrix of time-varying controls; $\alpha_s$ is the country of release fixed effect; $\gamma_t$ is the time fixed effect; $\epsilon_{r,c,s,t}$ is the error term.

While the focus of this strategy is on composer rights, we refer to work done by Cuntz [2022] in order to validate the status proxy across all contributors to a single work, for a subsample of individual opera works, the author searched for and included available information on other (non-composer) authors involved in the creation of the work. This is potentially relevant to the assessment of copyright status of the work based on the 'last living author' (say, the death of one or more librettists of an opera). In cases where the copyright status of the opera transitions during the observation period, it is found that for 81 % of works by multiple contributors the proxy is validated. In cases where works' status are always public domain, it was found that for 92.5 % this holds true, i.e. false negatives account for 7.5 % in the sample.[16]

# 6 Results

## 6.1 Recording rights

Table 4 presents the main outcomes of model 1 for physical re-releases of classical music and opera in particular. In the baseline specifications, columns (1) and (2), the coefficient estimates show a positive and statistically significance impact of the public domain explanatory variable, demonstrating an increase in magnitude when adding the opera FE (16.3%) rather than the Composer FE (12%).[17] From column (3) to (4), we enhance the

[16]Here, Cuntz [2022] draws another 10-per-cent random sample from the total sample of works classified as always public domain, i.e. based on the death of the composer alone, and compares these to the latest death of other collaborators in the work, if applicable.

[17]Since the Poisson model specification, the percent increase is given by $e^{\beta} - 1$.

model by adding the control variables. The point estimates remain stable, respectively, 10.9% in the case of Composer FE, and 13.4% in the case of opera FE.

In model (5) and (6) we control for recording age and recording year fixed effects. Moreover, we allow each country to have its own unrestricted "trend", without assuming trend linearity. Both model specifications show an increase in estimation magnitude, ranging from 39.7% to 58.2%. In addition, the model selection criteria suggest that the models fit better compared to the previous.[18]

Since our results could be triggered by the jump from copyright to public domain status of top performers' recordings, in Table 34 of the Online Appendix we interact the main explanatory variable with an indicator variable equal one if a top performer, conductor or orchestra performed in the recording; and zero otherwise.[19] Independently of the model specification, the interaction term coefficient does not play a significant role. In other words, the top performers induced bias is negligible in our models.

Table 5 displays the outcomes for the digital re-release of music.[20] All model specifications show no significant impact of the public domain status on the digitization of recorded opera. This confirms earlier evidence provided in MacGarvie et al. [2021] that recording rights status impacts availability online differently compared to availability of physical releases. However, once we interact the main explanatory variable with a dummy variable of streaming adoption in each member state, in Table 6 we observe a slightly positive impact of public domain status on digital releases. On the other hand, the interaction term appears negative, meaning that the rise of digital streaming platforms - despite the positive public domain status effect - implies a decrease in digital releases, pointing to a higher inclusion rate of works to online catalogues still protected under recording rights.

[18]Compared with the initial database (112,176 observations), the results presented in Table 4 include 107,481 observations. The sample reduction relates to the separated observations by fixed effect and by Poisson model iteration in the more demanding specification (column 6). For consistency, the other models are also estimated on the same sample. Due to the separated observations by Poisson model iteration, an additional eight observations are missing in model 5. The sample relates to 5,902 opera-composer-country physical release recordings.

[19]See Tables 32 and 33 for further details on the top performers.

[20]The sample relates to 1,486 opera-composer-country digital release recordings.

### 6.1.1 Identifying Assumption and Staggered Difference-in-Differences Estimates

Given the staggered adoption of the EU Directive 2011/77 because the Directive was only subsequently implemented in national laws of member states ('national implementation'), the copyright expiry year in each country varies over time Ramalho and Lopez-Tarruella [2018].[21] For this reason, the estimates of the models presented in the previous section could suffer of bias. Specifically, in a staggered $DiD$ set up the coefficient of interest is computed as a weighted average of all possible (2x2) comparisons. Negative weights in the coefficient estimates could arise since the two-way fixed effect model identifies weighted sums of the average treatment effects in each group and period. Broadly, $\hat{\beta}$ coefficient is computed comparing the not-yet-treated groups, and the already-treated groups. The computation could lead to negative weights. For instance, Sun and Abraham [2021] show that, in the case of variation in treatment across units, the regression coefficients are not robust to the heterogeneous or dynamic treatment effects across group and time. Moreover, a recent strand of the literature highlights the issue and proposes several ways to deal with the problem (De Chaisemartin and D'Haultfœuille [2020], Callaway and Sant'Anna [2021], Goodman-Bacon [2021], Sun and Abraham [2021], Athey and Imbens [2022]).

As in the previous section, the adoption of linear estimators permits to check the aforementioned threats to identification in case of a staggered $DiD$ setting. Specifically, we employ estimation procedures proposed by Callaway and Sant'Anna [2021] (hereafter CS). Aggregating group-time treatment effects into average effects across different treatment period exposure,[22] the CS estimator overcomes the negative weights problem recently highlighted in the literature. Table 12 presents the estimation results for the different models. Model (1) and (2) analyze the coefficient estimates when considering physical re-releases as the dependent variable, without and with control variables respectively. In both cases, the estimates reveal a positive and significant impact of the public domain

[21] In our setting, we have more than two time periods and heterogeneity in treatment time.
[22] Control group includes only the never treated, or the not-yet-treated.

status on physical re-releases. In model (3) and (4), we use dummy dependent variables to examine physical re-releases. Likewise, we find positive and significant coefficient estimates without covariates (model (3)) and with covariates (model (4)). Additionally, we employ the CS estimator to study the impact of the public domain status on digital re-releases. In this scenario as well, the outcomes are significant and positive, but they exhibit a higher magnitude compared to the analysis of physical re-releases. These results support the initial intuition of a positive impact of public domain status on digital re-releases, as shown in Table 6. Overall, regardless of the dependent variable under consideration, we observe a positive impact of the public domain status of recordings on both physical and digital re-releases, ranging from approximately 1 to 4.7 percentage points.

In Figure 4 and Figure 5 we plot the CS time-varying estimates for physical releases and digital ones, respectively. The coefficient outcomes suggest that the parallel trends assumption plausibly holds. Notably, the impact of the Directive adoption appears short-lived, namely prominent one to two years after the adoption. This result is consistent with the ATT plots by groups (see, panel C and D of Figure 4, and panel B of Figure 5). In all model specification the 2013 and 2014 member states adopters are the main driver of our results.

### 6.1.2 Placebo Analysis

To validate the sensitivity of our results to pre-period trend differences, we perform a placebo intervention tests. Specifically, we create a false treatment for one-year and two-year before the true event. Table 13 reports the coefficient estimates of the CS estimator in case of one-year and two-year false treatment for three dependent variables specification: the physical release count variable; the dummy of physical release; and the dummy of digital release. Independently of the dependent variable specification, we do not observe a significant ATT impact of the one-year or the two-year false treatment.

Taken together, the placebo analyses support the idea that, in the absence of the treatment, there is no systematic trend in the data that would otherwise explain the increases in recording releases.

### 6.1.3 Estimator Choice

In this section, we provide evidence that our results are not driven by the estimator choice. Specifically, Table 14 shows results using the OLS (instead of Pseudo-Poisson estimator) for physical re-releases. Despite the reduction of magnitude, the coefficient estimates of the main explanatory variable remain positive and significant, ranging from 0.7% to 2.7%. In a similar way, Table 35 presents the estimates when including the public domain (recording right) and top performer interaction term. Again, we observe a reduction in estimate magnitude; however, both effect direction and significance level remain in line with the results reported in the non-linear estimates specification presented in Table 34 (both tables reported in the online appendix).

Concerning digital releases, Table 15 presents the estimates when adopting a logit model specification. In that model specification, we do not find a significant impact of the public domain status (given the EU Directive adoption) on digital releases. Similarly, Table 37 presents estimation results when including the public domain status (recording right) and top performer interaction term. Again, coefficient estimates are consistent with the linear model specification, Table 36 (both tables reported in the online appendix).

In sum, estimates in this section confirm that results are highly robust and independent from model specification.

## 6.2 Author rights

Tables 20 and 21 present the main Poisson coefficient estimates from our analyses. Our main variables of interest, *always PD* and *transitions*, are variables which represent the number of records or releases of a composition in digital and physical channels, respectively. The estimates are presented with respect to the *always copyright* benchmark category and Tables 16, 17, 18, and 19 describe the sample used in these analyses.

Table 20 presents the main outcomes of our models for digital releases. In the baseline specifications, columns (1) and (2), the estimates show a 135-138% increase in the

probability of observing a recording or release of a record in a given year for composition in public domain. However this effect diminishes and is no longer observed when we account for recording age effects in columns (4) and (6). This suggests that much of the increased availability initially observed is due to changes in popularity of the recordings over time.

Table 21 presents the main outcomes of our models for physical releases. In all specifications, we fail to observe any significant effect of public domain status on the availability of music in physical formats.

### 6.2.1 Estimator choice

Given the count nature of outcome variable (number of releases), and the relative rarity of observing a non-zero outcome - the average composition is released as a record less than 0.15 times during the observation period - we have used a Poisson estimator in the preceding models. As a result, we have implicitly assumed that our outcomes follow a Poisson distribution, rather than a normal distribution. In models presented in Tables 22 and 23 we instead assume normal distribution and present the results of models using ordinary least squares (OLS) estimator. We similarly observe little relationship between copyright status and digital or physical releases in these OLS specifications.

### 6.2.2 Restricted sample analyses

Going further, we implement similar analyses using a more conservative sample that attempts to more strictly identify author rights effects by accounting for three factors. First, to minimise the influence of an opera age effect, or differences in circumstances of opera creation, we focus only on works that were created (i.e., premiered) in a narrow period of time (1901 - 1948). Hence our models include only works that were created in the first half of the twentieth century. Second, to account for changes in popularity of works that may occur shortly after death (see Ursprung and Wiermann [2008] for a study on the visual arts sector), we have further restricted our observations to only include operas by composers who have died at least 10 years ago from the start of our observation period and works that were produced at least 50 years from the start of our observation

period. Thus our sample includes only compositions older than 50 years that were created around the same time by authors who have been dead for at least 10 years. Third, we follow each recording of a composition strictly and measure as our explained variable - whether an observed record is re-released during our observation period (assigned a value of 1) or not (assigned a value of 0).[23]

We observe that this effect of public domain status on digital opera music releases seems to be greatest when the transition from protected to public domain status occurs during our observation period (2000 - 2018). All other observables held constant, public domain status results in a 129% - 144% increase in the probability of observing a release of a record in a given year. Whereas for those compositions that transitioned during our observation period, we observe a 140% to 332% increase in the probability of observing a release in a given year in our baseline models. In addition, we observe an increase in the probability of observing a release in a given year of 148% for records in the *transitions* group compared to those records that are always protected in model 6, however this effect is only marginally significant. We do not observe any significant effects in the specifications outlined in some of the more demanding models (3), (4) and (5).

On the other hand, the coefficients for physical releases that are *always public domain*, reported in table 29 are consistently not significantly different from zero. Nonetheless, for those records in the *transitions* group, we observe effect sizes that range from 34% (marginally significant) increase in model (4) to 40% (fully statistically significant) in model (6). We do not observe any statistically significant difference between the *transitions* and *always copyright* categories in models (1), (2), (3) and (5).

[23]In fact, we observe a maximum of one re-release under this configuration therefore the outcome variables are defacto dichotomous (0 and 1). Tables 24, 25, 26 and 27 describe the restricted sample used in these analyses

# 7 Discussion and limitations of the approach

Our results largely confirm previous findings in MacGarvie et al. [2021]. In most cases public domain status of related rights increases the availability of recorded music. Core findings on the distributional effects of copyright continue to hold across EU member states, for a different genre (classical music) and in an environment dominated by popular public domain works. As we can explicitly account for author rights in the analytical framework, we can now be more confident that the causal effect on distribution identified in MacGarvie et al. [2021] is not diluted by the simultaneous presence of author rights on music recordings, an issue their approach could not account for.

On the other hand, we find no evidence that public domain status of author rights diminishes availability. Similar to Buccafusco and Heald [2013], we argue that this suggests there is little evidence to support the fear that when works eventually fall into the pubic domain - and thus lack the care of a copyright-motivated protector - their availability decreases. We however note again that, in the case of author rights, our research design does not allow for full causal identification of effects and we cannot rule out the possibility that true estimates are downward biased by anticipation behavior of right holders as discussed in section 5.2. This issue is left to future research.

This research also extends the copyright economics literature on the creation and distribution of classical music. We contribute and deepen our understanding on the economic effects of intellectual property rights granted along the value chain in classical music. Giorcelli and Moser [2020] finds a positive effect on the production of new opera with the introduction of moderate copyright terms in Napoleonic Italy. Her research shows robust evidence on the incentives to create that copyright laws provide. We complement that with new findings on distributional effects of laws, which now extends from an analysis of right status around the programming and staging of operatic works (Cuntz [2022]) to the effect on recording and re-releases of classical music in different distribution channels studied in this paper. At large, all evidence indicates that there is a delicate and

sometimes difficult balance to strike for law-makers between the upstream incentives to create new works and the downstream incentive to distribute and stage existing works, in particular in the classical music context. Still, a more refined welfare analysis (Reimers [2019]) is due and more research will be needed to conclude on how the current system may be improved to even more effectively balance the promotion of the supply of new and old works.

Notwithstanding the debates by legal scholars around the functioning of the licensing system for digital uses of music in the last decade (Schwemer [2014], Priest [2021]), our research provides proof and data that classical music is actively being released in digital channels. Notably, it becomes clear that the introduction of catalogue-wide licensing of streaming services may have helped to overcome some of the perceived licensing hurdles and distributional effects of copyright and related rights we have documented in this paper, which again confirm the intuition developed in MacGarvie et al. [2021]. With better data and in future research, it might be equally interesting to further study who actually digitizes and selects works from the body of existing physical recordings (record labels, commercial vendors, libraries, archives, etc.), who bears the cost to do so, and when this is most likely to happen in the course of music production and distribution cycles and around strategic decisions taken by stakeholders. Moreover, while this research speaks to the distributional effects of laws on the availability of works, it stays silent on the income streams and royalty flows exclusive rights generate to creators, performers, and record labels, and music publishers; and the sharing of revenues along the value chain in particular in the new digital environment (WIPO [2021]). While there is some economic evidence on authorship profitability under different terms of protection by MacGarvie and Moser [2015], it is still scarce and hence another important field for future economic research.

# 8 Conclusion

In this paper we have examined the distributional effects of copyright (i.e., author rights) and related rights (i.e., recording rights) using a natural experiment and recent changes in European law introduced under EU Directive 77/2011. We examine the causal implications of copyright and related rights protection of music recordings vis-à-vis public domain status for the availability of classical music as physical and digital releases. Results suggest that public domain status of related rights favours the availability and re-releases of classical music in physical and digital formats with an effect size that ranges from 11% to 58% depending on the model specification. The emergence of music streaming services in the EU and catalogue-wide licensing moderate effects over time. Public domain status of author rights on the other hand appears to have little to zero impact on classical music releases.

Altogether, we have argued that while copyright (and related rights) are beneficial for creativity, so are copyright term limits. In this paper, we have quantified the benefits of those term limits in the EU. Finally, we propose that further research is required to identify the ideal configuration(s) to extract maximum welfare from copyright protection and copyright term limits while noting other limitations of this paper.

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# Tables and Figures

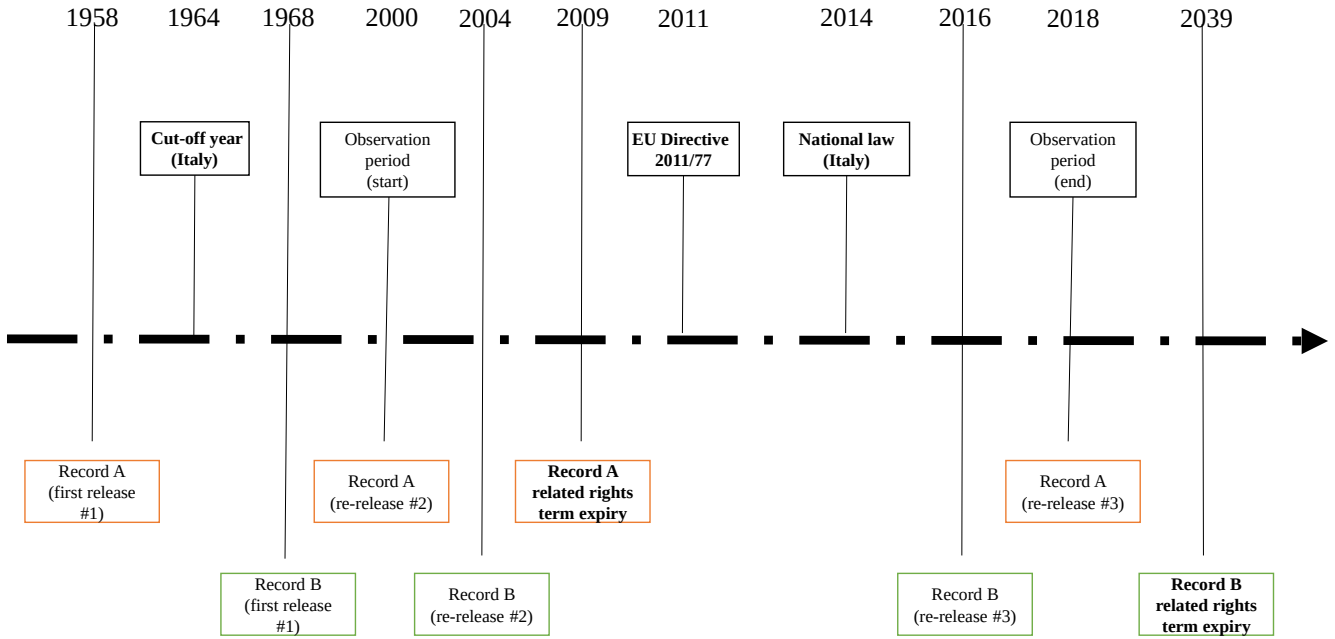



Fig. 1: Sample timeline (recording rights)

*Notes* : This chart shows the timeline for hypothetical records A and B in Italy. Our observation period (2000-2018) covers the years that the records in our sample were released.

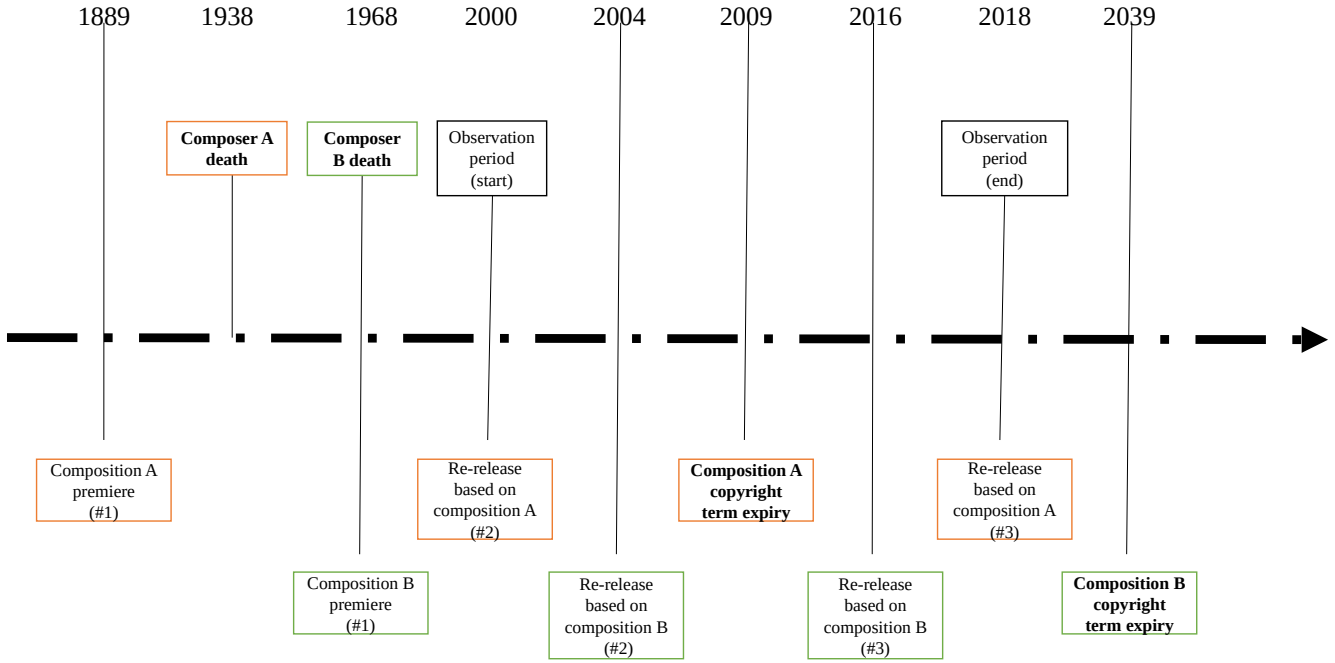
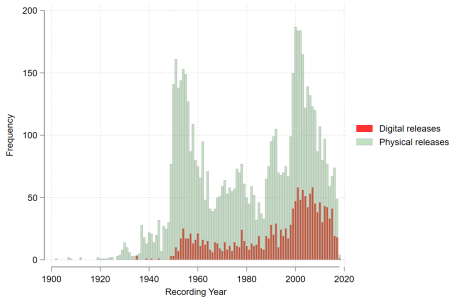


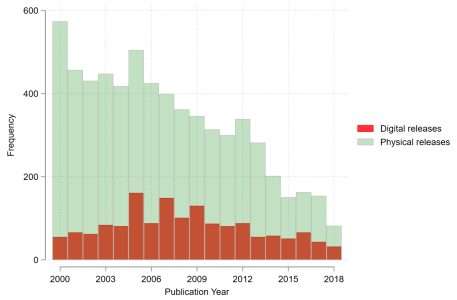

Fig. 2: Sample timeline (author rights)

*Notes* : This chart shows the timeline for hypothetical compositions A and B created by composers A and B respectively. Note that although this chart only shows compostitions whose copyright expires during or after our observation period, we also observe compositions whose copyright expired before our observation period. Our observation period (2000-2018) covers the years that the records in our sample were released.

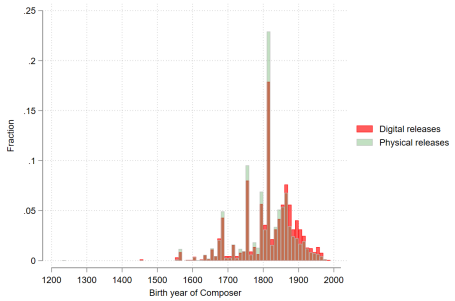
Fig. 3: Descriptives




Panel A: Opera recordings by recording year




Panel B: Opera recordings by publication year




Panel C: Composer's year of birth

Table 1: Physical recordings by country

| | Freq. | Percent |
|---|---|---|
| Austria | 2653 | 2.468 |
| Belgium | 398 | 0.370 |
| Croatia | 747 | 0.695 |
| Czech Republic | 845 | 0.786 |
| Denmark | 251 | 0.234 |
| Finland | 96 | 0.0893 |
| France | 9890 | 9.202 |
| Germany | 27222 | 25.33 |
| Hungary | 221 | 0.206 |
| Ireland | 16 | 0.0149 |
| Italy | 15475 | 14.40 |
| Netherlands | 7376 | 6.863 |
| Poland | 424 | 0.394 |
| Portugal | 1441 | 1.341 |
| Slovenia | 1089 | 1.013 |
| Spain | 7730 | 7.192 |
| Sweden | 861 | 0.801 |
| UK | 30746 | 28.61 |
| Total | 107481 | 100 |

Table 2: Digital recordings by country

| | Freq. | Percent |
|---|---|---|
| Austria | 285 | 1.009 |
| Belgium | 285 | 1.009 |
| Czech Republic | 304 | 1.077 |
| Denmark | 323 | 1.144 |
| Finland | 228 | 0.808 |
| France | 1824 | 6.460 |
| Germany | 8094 | 28.67 |
| Hungary | 209 | 0.740 |
| Italy | 2394 | 8.479 |
| Netherlands | 703 | 2.490 |
| Poland | 57 | 0.202 |
| Spain | 361 | 1.279 |
| Sweden | 418 | 1.480 |
| UK | 12749 | 45.15 |
| Total | 28234 | 100 |

Table 3: Summary statistics

| | Count | Mean | Min | Max | Sd |
|---|---|---|---|---|---|
| Publication year | 140448 | 2009.00 | 2000 | 2018 | 5.48 |
| Recording re-release | 140448 | 0.06 | 0 | 9 | 0.26 |
| Physical recording re-release | 140448 | 0.05 | 0 | 9 | 0.24 |
| Digital recording release indicator | 140448 | 0.01 | 0 | 1 | 0.10 |
| Public domain | 140448 | 0.19 | 0 | 1 | 0.40 |
| Composer Public Domain (at Publication Year) | 140448 | 0.79 | 0 | 1 | 0.41 |
| Composer/Performers Public Domain | 140448 | 0.17 | 0 | 1 | 0.37 |
| Composer Public Domain (at Recording Year) | 140448 | 0.72 | 0 | 1 | 0.45 |
| No top 5 composers indicator | 140448 | 0.67 | 0 | 1 | 0.47 |
| Recording Year | 140448 | 1983.90 | 1902 | 2018 | 22.92 |
| Birth year | 140448 | 1808.03 | 1235 | 1984 | 74.63 |
| Death year | 136211 | 1869.56 | 1288 | 2021 | 76.09 |
| Live recording | 140448 | 0.19 | 0 | 1 | 0.39 |
| Digital release | 140448 | 0.20 | 0 | 1 | 0.40 |
| Top Performers | 140448 | 0.53 | 0 | 1 | 0.50 |
| Recording contributors | 140448 | 11.15 | 1 | 601 | 9.86 |
| Holdings | 140448 | 68.12 | 0 | 850 | 98.16 |
| Composer death anniversary | 140448 | 0.03 | 0 | 1 | 0.16 |
| Composer birth anniversary | 140448 | 0.04 | 0 | 1 | 0.20 |
| Recording-Country equal language | 140448 | 0.35 | 0 | 1 | 0.48 |

Table 4: Copyright status and physical re-releases

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| Public Domain (Recording) | 0.1219*** | 0.1514*** | 0.1033** | 0.1310** | 0.3344*** | 0.4585*** |
| | (0.0307) | (0.0430) | (0.0331) | (0.0457) | (0.0946) | (0.1149) |
| Controls | | | Yes | Yes | Yes | Yes |
| Publication Year FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Country FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Composer FE | Yes | | Yes | | Yes | |
| Opera FE | | Yes | | Yes | | Yes |
| Recording Age FE | | | | | Yes | Yes |
| Recording Year FE | | | | | Yes | Yes |
| Country-Publication Year FE | | | | | Yes | Yes |
| N | 107,481 | 107,481 | 107,481 | 107,481 | 107,473 | 107,481 |
| AIC | 50,296.41 | 49,929.48 | 50,224.62 | 49,854.12 | 48,844.55 | 48,401.98 |
| BIC | 50,315.58 | 49,948.65 | 50,320.47 | 49,949.97 | 48,949.98 | 48,507.41 |

*Notes* : Significance: *** p<0.001, ** p<0.01, * p<0.05. Standard errors are clustered at the opera-composer-country release recordings group. Coefficients are computed using the pseudo-maximum likelihood model with multi-way fixed effects. Dependent variable: counter of physical re-release of opera recordings. Control variables include: Public Domain (Author) dummy, interaction term for Public Domain (Author) and Public Domain (Recording) in (5) and (6), dummy for live recordings; recording contributors; $25^{th}$ death and birth opera composer anniversaries; recording-country equal language; top performers/orchestras/conductors indicator; dummy for the composer public domain status at the recording year.

Table 5: Copyright status and digital re-releases

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| Public Domain (Recording) | 0.0016 | 0.0020 | 0.0014 | 0.0018 | 0.0079 | 0.0150 |
| | (0.0033) | (0.0054) | (0.0034) | (0.0055) | (0.0148) | (0.0191) |
| Controls | | | Yes | Yes | Yes | Yes |
| Publication Year FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Country FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Composer FE | Yes | | Yes | | Yes | |
| Opera FE | | Yes | | Yes | | Yes |
| Recording Age FE | | | | | Yes | Yes |
| Recording Year FE | | | | | Yes | Yes |
| Country-Publication Year FE | | | | | Yes | Yes |
| N | 28,234 | 28,234 | 28,234 | 28,234 | 28,234 | 28,234 |
| R-squared | 0.01 | 0.01 | 0.01 | 0.01 | 0.03 | 0.04 |

*Notes* : Significance: *** p<0.001, ** p<0.01, * p<0.05. Standard errors are clustered at the opera-composer-country release recordings group. Dependent variable: dummy variable equal 1 in case of digital re-release, 0 otherwise. Coefficients are computed using the linear regression with multi-way fixed effects. Control variables include: Public Domain (Author) dummy, interaction term for Public Domain (Author) and Public Domain (Recording) in (5) and (6), dummy for live recordings; recording contributors; $25^{th}$ death and birth opera composer anniversaries; recording-country equal language;top performers/orchestras/conductors indicator, dummy for the composer public domain status at the recording year.

Table 6: Copyright status and digital re-releases - streaming adoption

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| Public Domain (Recording) | 0.0229* | 0.0276* | 0.0233* | 0.0281* | 0.0197 | 0.0284 |
| | (0.0104) | (0.0130) | (0.0106) | (0.0131) | (0.0201) | (0.0239) |
| Public Domain (Recording) × Streaming Adoption | -0.0280* | -0.0320* | -0.0287* | -0.0329* | -0.0141 | -0.0160 |
| | (0.0128) | (0.0144) | (0.0129) | (0.0144) | (0.0145) | (0.0152) |
| Controls | | | Yes | Yes | Yes | Yes |
| Publication Year FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Country FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Composer FE | Yes | | Yes | | Yes | |
| Opera FE | | Yes | | Yes | | Yes |
| Recording Age FE | | | | | Yes | Yes |
| Recording Year FE | | | | | Yes | Yes |
| Country-Publication Year FE | | | | | Yes | Yes |
| N | 28,234 | 28,234 | 28,234 | 28,234 | 28,234 | 28,234 |
| R-squared | 0.01 | 0.01 | 0.01 | 0.01 | 0.03 | 0.04 |

*Notes* : Significance: *** p<0.001, ** p<0.01, * p<0.05. Standard errors are clustered at the opera-composer-country release recordings group. Dependent variable: dummy variable equal 1 in case of digital re-release, 0 otherwise. Coefficients are computed using the linear regression with multi-way fixed effects. Control variables include: Public Domain (Author) dummy, interaction term for Public Domain (Author) and Public Domain (Recording) in (5) and (6), dummy for live recordings; recording contributors; $25^{th}$ death and birth opera composer anniversaries; recording-country equal language;top performers/orchestras/conductors indicator, dummy for the composer public domain status at the recording year.

Table 7: Treated recordings

| | Physical releases | | Digital releases | |
|---|---|---|---|---|
| | Freq. | Percent | Freq. | Percent |
| Not Treated | 77064 | 68.70 | 24339 | 86.09 |
| 2013 | 10412 | 9.28 | 2546 | 9.01 |
| 2014 | 17480 | 15.58 | 1216 | 4.30 |
| 2015 | 4674 | 4.17 | 171 | 0.60 |
| 2016 | 2527 | 2.25 | | |
| 2017 | 19 | 0.02 | | |
| Total | 112176 | 100.00 | 28272 | 100.00 |

*Notes* : The table shows the time treatment heterogeneity due to the EU Directive adoption year. The small group (year 2017) of observations refers only to the Slovakia recording observations (the last member state that adopted the EU Directive).

Table 8: Physical treated recordings per country

| | Freq. | Percent |
|---|---|---|
| Austria | 1444 | 4.11 |
| Belgium | 19 | 0.05 |
| Croatia | 760 | 2.16 |
| Czech Republic | 304 | 0.87 |
| Denmark | 38 | 0.11 |
| France | 1976 | 5.63 |
| Germany | 8645 | 24.62 |
| Ireland | 19 | 0.05 |
| Italy | 8778 | 25.00 |
| Netherlands | 627 | 1.79 |
| Poland | 19 | 0.05 |
| Portugal | 969 | 2.76 |
| Slovakia | 19 | 0.05 |
| Slovenia | 1064 | 3.03 |
| Spain | 2071 | 5.90 |
| Sweden | 133 | 0.38 |
| UK | 8227 | 23.43 |
| Total | 35112 | 100.00 |

*Notes* : The table shows the physical treated recordings by country given the EU Directive adoption.

Table 9: Physical untreated recordings per country

| | Freq. | Percent |
|---|---|---|
| Austria | 1501 | 1.95 |
| Belgium | 589 | 0.76 |
| Croatia | 779 | 1.01 |
| Czech Republic | 741 | 0.96 |
| Denmark | 437 | 0.57 |
| Estonia | 19 | 0.02 |
| Finland | 228 | 0.30 |
| France | 7961 | 10.33 |
| Germany | 18696 | 24.26 |
| Hungary | 437 | 0.57 |
| Ireland | 57 | 0.07 |
| Italy | 6840 | 8.88 |
| Netherlands | 6783 | 8.80 |
| Poland | 494 | 0.64 |
| Portugal | 1520 | 1.97 |
| Slovenia | 817 | 1.06 |
| Spain | 5681 | 7.37 |
| Sweden | 836 | 1.08 |
| UK | 22648 | 29.39 |
| Total | 77064 | 100.00 |

*Notes* : The table shows the physical untreated recordings by country given the EU Directive adoption.

Table 10: Digital treated recordings per country

| | Freq. | Percent |
|---|---|---|
| Czech Republic | 76 | 1.93 |
| Denmark | 19 | 0.48 |
| France | 95 | 2.42 |
| Germany | 1121 | 28.50 |
| Hungary | 19 | 0.48 |
| Italy | 57 | 1.45 |
| Netherlands | 76 | 1.93 |
| Sweden | 19 | 0.48 |
| UK | 2451 | 62.32 |
| Total | 3933 | 100.00 |

*Notes* : The table shows the digital treated recordings by country given the EU Directive adoption.

Table 11: Digital untreated recordings per country

| | Freq. | Percent |
|---|---|---|
| Austria | 285 | 1.17 |
| Belgium | 285 | 1.17 |
| Bulgaria | 19 | 0.08 |
| Czech Republic | 228 | 0.94 |
| Denmark | 304 | 1.25 |
| Estonia | 19 | 0.08 |
| Finland | 228 | 0.94 |
| France | 1729 | 7.10 |
| Germany | 6973 | 28.65 |
| Hungary | 190 | 0.78 |
| Italy | 2337 | 9.60 |
| Netherlands | 627 | 2.58 |
| Poland | 57 | 0.23 |
| Spain | 361 | 1.48 |
| Sweden | 399 | 1.64 |
| UK | 10298 | 42.31 |
| Total | 24339 | 100.00 |

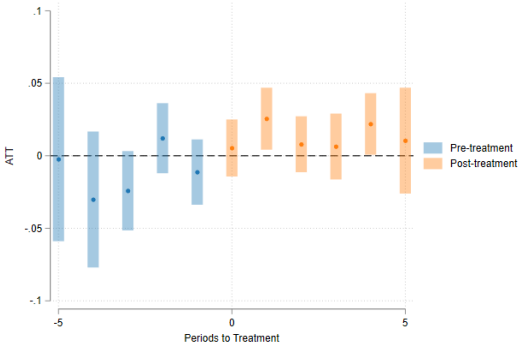
*Notes* : The table shows the digital untreated recordings by country given the EU Directive adoption.

Table 12: CS Event study estimation - Copyright status and re-releases

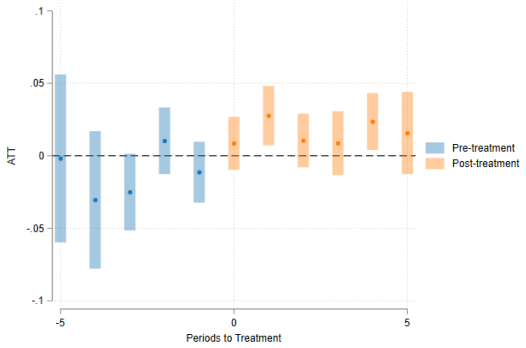
| | (1) Physical Releases Counter | (2) Physical Releases Counter | (3) Dummy Physical Releases | (4) Dummy Physical Releases | (5) Dummy Digital Releases | (6) Dummy Digital Releases |
|---|---|---|---|---|---|---|
| ATT | 0.0095* | 0.0130** | 0.0112** | 0.0156*** | 0.0464*** | 0.0476*** |
| | (0.0055) | (0.0062) | (0.0048) | (0.0056) | (0.0100) | (0.0112) |
| Controls | | Yes | | Yes | | Yes |

*Notes* : Significance: *** p<0.01, ** p<0.05, * p<0.10. The coefficients are computed using the CS doubly robust estimator (Callaway and Sant'Anna [2021]). Standard errors are cluster robust and estimated using the wild bootstrap procedure. Control group in the models: never treated. The models include publication year FE and opera-composer per country FE. Control variables include: dummy for composer public domain status; dummy for live recordings; recording contributors; $25^{th}$ death and birth opera composer anniversaries; recording-country equal language; dummy for the starting year of music streaming services (for the models (5) and (6)); top performers/orchestras/conductors indicator; dummy for the composer public domain status at the recording year.

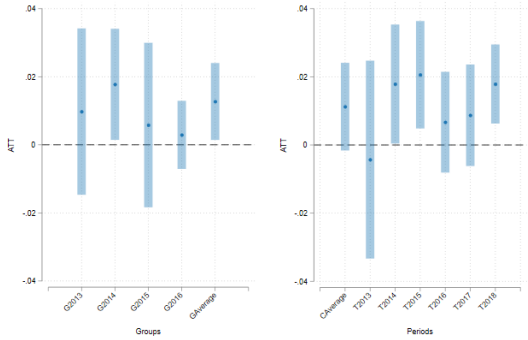
Fig. 4: Copyright status and physical re-release: time-varying estimates and time-varying estimates by cohort and year



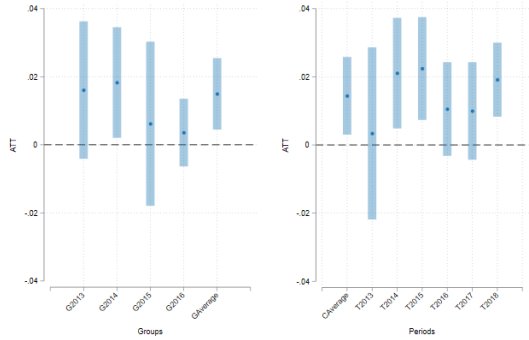

Panel A




Panel B



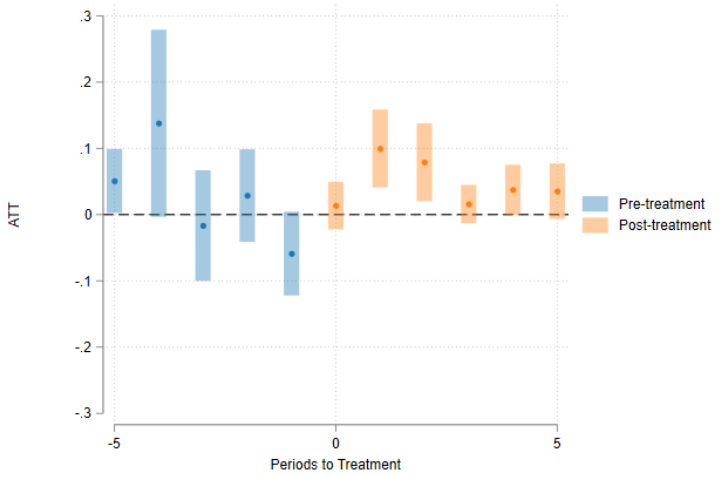

Panel C



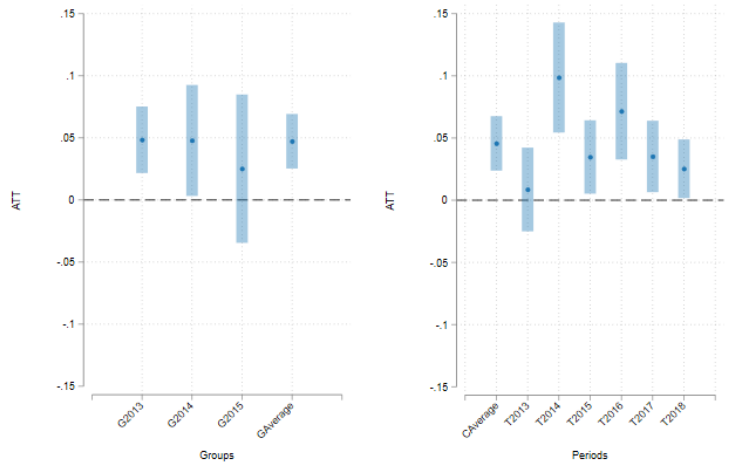

Panel D

*Notes:* The graphs plot the estimates and 95-percent-confidence intervals from leads-and-lags CS estimator and by cohort and year (Panel C) (Callaway and Sant'Anna [2021]). Standard errors are cluster robust and estimated using the wild bootstrap procedure. In Panel A and C, the outcome variable is the counter of physical re-release. In Panel B and D, the outcome variable is a dummy equal to one in case of physical re-release, zero otherwise. Control group in both models: never treated. Estimates exclude the 2017 small group. Sample restricted to the years 2010-2018. The models include publication year FE and opera-composer-recording per country FE. Control variables include: dummy for composer public domain status; dummy for live recordings; recording contributors; $25^{th}$ death and birth opera composer anniversaries; recording-country equal language;top performers/orchestras/conductors indicator; dummy for the composer public domain status at the recording year.

Fig. 5: Copyright status and digital releases: time-varying estimates and time-varying estimates by cohort and year




Panel A




Panel B

*Notes:* The graphs plot the estimates and 95-percent-confidence intervals from leads-and-lags CS estimator and by cohort and year (Panel B) (Callaway and Sant'Anna [2021]). Standard errors are cluster robust and estimated using the wild bootstrap procedure. The dependent variable is a dummy equal one in case of digital releases, zero otherwise. Control group: never treated. Estimates exclude the 2017 small group. Sample restricted to the years 2009-2018. The model includes publication year FE and opera-composer-recording per country FE. Control variables include: dummy for composer public domain status; dummy for live recordings; recording contributors; $25^{th}$ death and birth opera composer anniversaries; recording-country equal language; dummy for the starting year of music streaming services; top performers/orchestras/conductors indicator; dummy for the composer public domain status at the recording year.

Table 13: CS Event study estimation (placebo analysis) - Copyright status and re-releases

| | (1) Physical Releases Counter, lag one | (2) Dummy Physical Releases Counter, lag one | (3) Dummy Digital Releases, lag one | (4) Physical Releases Counter, lag two | (5) Dummy Physical Releases, lag two | (6) Dummy Digital Releases, lag two |
|---|---|---|---|---|---|---|
| ATT | -0.0052 | -0.0036 | -0.0220 | 0.0056 | 0.0052 | 0.0064 |
| | (0.0069) | (0.0065) | (0.0220) | (0.0066) | (0.0066) | (0.0176) |
| Controls | Yes | Yes | Yes | Yes | Yes | Yes |

*Notes* : Significance: *** p<0.01, ** p<0.05, * p<0.10. The coefficients are computed using the CS doubly robust estimator (Callaway and Sant'Anna [2021]). Standard errors are cluster robust and estimated using the wild bootstrap procedure. Control group in the models: never treated. The models include publication year FE and opera-composer per country FE. Control variables include: dummy for composer public domain status; dummy for live recordings; recording contributors; $25^{th}$ death and birth opera composer anniversaries; recording-country equal language; dummy for the starting year of music streaming services (for the models (3) and (6)); top performers/orchestras/conductors indicator; dummy for the composer public domain status at the recording year.

Table 14: Copyright status and physical re-releases - Linear Model

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| Public Domain (Recording) | 0.0072*** | 0.0094** | 0.0059** | 0.0077* | 0.0198** | 0.0270*** |
| | (0.0019) | (0.0029) | (0.0020) | (0.0030) | (0.0062) | (0.0076) |
| Controls | | | Yes | Yes | Yes | Yes |
| Publication Year FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Country FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Composer FE | Yes | | Yes | | Yes | |
| Opera FE | | Yes | | Yes | | Yes |
| Recording Age FE | | | | | Yes | Yes |
| Recording Year FE | | | | | Yes | Yes |
| Country-Publication Year FE | | | | | Yes | Yes |
| N | 107,481 | 107,481 | 107,481 | 107,481 | 107,481 | 107,481 |
| R-squared | 0.01 | 0.01 | 0.01 | 0.01 | 0.03 | 0.03 |

*Notes* : Significance: *** p<0.001, ** p<0.01, * p<0.05. Standard errors are clustered at the opera-composer-country release recordings group. Dependent variable: counter of physical re-release of opera recordings. Coefficients are computed using the linear regression with multi-way fixed effects. Control variables include: dummy for live recordings; recording contributors; $25^{th}$ death and birth opera composer anniversaries; recording-country equal language;top performers/orchestras/conductors indicator, dummy for the composer public domain status at the recording year.

Table 15: Copyright status and digital re-release - Logit model

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| Public Domain (Recording) | 0.2952 | 0.3846 | 0.3887 | 0.4755 | 0.2230 | 0.3631 |
| | (0.1613) | (0.1965) | (0.3062) | (0.3694) | (0.3586) | (0.4128) |
| Public domain (Recording) | | | | | | |
| × Streaming adoption | -0.4158* | -0.4916* | -0.4336* | -0.5117* | -0.1682 | -0.2373 |
| | (0.2062) | (0.2196) | (0.2071) | (0.2201) | (0.2261) | (0.2328) |
| Controls | | | Yes | Yes | Yes | Yes |
| Country FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Opera FE | | Yes | | Yes | | Yes |
| Composer FE | Yes | | Yes | | Yes | |
| Recording Age FE | | | | | Yes | Yes |
| Recording Year FE | | | | | Yes | Yes |
| Publication Year FE | | | | | Yes | Yes |
| Country-Publication Year FE | Yes | Yes | Yes | Yes | Yes | Yes |
| N | 28,272 | 28,272 | 28,272 | 28,272 | 26,958 | 26,958 |
| Pseudo R-squared | 0.02 | 0.03 | 0.03 | 0.03 | 0.06 | 0.06 |

*Notes* : Significance: *** p<0.001, ** p<0.01, * p<0.05. Dependent variable: dummy variable equal 1 in case of digital re-release, 0 otherwise. Coefficients are computed using the logit model with multi-way fixed effects. Control variables include: dummy for live recordings; recording contributors; $25^{th}$ death and birth opera composer anniversaries; recording-country equal language;top performers/orchestras/conductors indicator, dummy for the composer public domain status at the recording year.

## Author rights

### Sample summary

Table 16: Author rights sample summary statistics: digital releases

| | mean | sd | min | max |
|---|---|---|---|---|
| Digital release | .1296124 | .393316 | 0 | 5 |
| Premiere year (composition) | 1925.195 | 21.14096 | 1901 | 2002 |
| Age at death | 70.23318 | 17.62018 | 20 | 101 |
| Streaming adoption | .6513178 | .4765901 | 0 | 1 |
| Recorded live | .1204134 | .3242863 | 0 | 1 |
| Num. of contributors to record | 10.75848 | 9.061569 | 1 | 308 |
| Recorded in local lang. | .3935142 | .4859194 | 0 | 1 |
| Performed by stars | .3596589 | .4775567 | 0 | 1 |
| Library holdings | 196.0642 | 78.95452 | 1 | 476 |
| Birth anniversary | .0164341 | .1271477 | 0 | 1 |
| War death | .0410853 | .1985028 | 0 | 1 |
| Publication year (record) | 2011.885 | 4.416244 | 2000 | 2018 |
| Recording age | 12.29566 | 15.76618 | 0 | 72 |
| Recording year | 1994.041 | 16.19353 | 1939 | 2017 |
| Copyright at recording | .494323 | .4988875 | 0 | 1 |
| Observations | 6450 | | | |

*Notes* : Statistics are based on a balanced panel of 662 operas.

Table 17: Author rights sample summary statistics: physical releases

| | mean | sd | min | max |
|---|---|---|---|---|
| Physical release | .1331846 | .4344636 | 0 | 11 |
| Premiere year (composition) | 1926.155 | 21.43312 | 1901 | 2001 |
| Age at death | 69.47282 | 17.80422 | 20 | 104 |
| Streaming adoption | .6100825 | .4877416 | 0 | 1 |
| Recorded live | .1205964 | .3210387 | 0 | 1 |
| Num. of contributors to record | 11.59191 | 9.866129 | 1 | 162 |
| Recorded in local lang. | .3648837 | .4759652 | 0 | 1 |
| Performed by stars | .3605405 | .4770178 | 0 | 1 |
| Library holdings | 52.87473 | 90.12364 | 0 | 588 |
| Birth anniversary | .0158223 | .1247901 | 0 | 1 |
| War death | .050202 | .2183661 | 0 | 1 |
| Publication year (record) | 2011.312 | 4.793008 | 2000 | 2018 |
| Recording age | 19.22892 | 21.55487 | 0 | 99 |
| Recording year | 1986.2 | 21.99947 | 1902 | 2017 |
| Copyright at recording | .5457155 | .4963816 | 0 | 1 |
| Observations | 23764 | | | |

*Notes* : Statistics are based on a balanced panel of 2,042 operas.

**Summary by treatment**

Table 18: Author rights sample summary statistics: digital releases by treatment

| | Always PD | Always copyright | Transitions | Total |
|---|---|---|---|---|
| Digital release | 0.232 | 0.179 | 0.205 | 0.201 |
| | (0.632) | (0.457) | (0.519) | (0.531) |
| Premiere year (composition) | 1911.3 | 1934.1 | 1926.5 | 1925.2 |
| | (11.60) | (23.53) | (15.19) | (21.14) |
| Age at death | 63.58 | 75.43 | 64.57 | 69.27 |
| | (13.24) | (13.20) | (14.57) | (14.67) |
| Streaming adoption | 0.715 | 0.704 | 0.596 | 0.684 |
| | (0.452) | (0.457) | (0.492) | (0.465) |
| Recorded live | 0.227 | 0.162 | 0.246 | 0.201 |
| | (0.404) | (0.369) | (0.432) | (0.396) |
| Num. of contributors to record | 12.59 | 11.11 | 9.952 | 11.32 |
| | (4.626) | (3.267) | (4.452) | (4.123) |
| Recorded in local lang. | 0.535 | 0.649 | 0.737 | 0.632 |
| | (0.488) | (0.473) | (0.442) | (0.476) |
| Performed by stars | 0.545 | 0.405 | 0.731 | 0.522 |
| | (0.487) | (0.490) | (0.441) | (0.495) |
| Library holdings | 188.9 | 216.5 | 184.2 | 200.6 |
| | (100.3) | (54.00) | (84.12) | (79.38) |
| Birth anniversary | 0.0366 | 0.0168 | 0.0117 | 0.0219 |
| | (0.188) | (0.129) | (0.108) | (0.147) |
| War death | 0.0854 | 0.0475 | 0.193 | 0.0916 |
| | (0.280) | (0.213) | (0.396) | (0.289) |
| Publication year (record) | 2011.5 | 2012.2 | 2010.9 | 2011.7 |
| | (4.209) | (4.000) | (4.698) | (4.256) |
| Recording age | 27.37 | 15.04 | 16.74 | 19.33 |
| | (20.77) | (18.21) | (17.02) | (19.59) |
| Recording year | 1979.5 | 1992.7 | 1989.2 | 1987.7 |
| | (21.28) | (16.84) | (15.41) | (18.96) |
| Copyright at recording | 0.934 | 0.0843 | 0.111 | 0.360 |
| | (0.210) | (0.276) | (0.296) | (0.471) |
| Observations | 775 | | | |

*Notes* : Table shows means with standard deviations in parentheses. Statistics are based on a balanced panel of 662 operas.

Table 19: Author rights sample summary statistics: physical releases by treatment

| | Always PD | Always copyright | Transitions | Total |
|---|---|---|---|---|
| Physical release | 0.283 | 0.218 | 0.201 | 0.230 |
| | (0.747) | (0.603) | (0.541) | (0.627) |
| Premiere year (composition) | 1916.0 | 1934.1 | 1921.2 | 1926.2 |
| | (18.68) | (23.34) | (13.30) | (21.43) |
| Age at death | 64.60 | 77.16 | 66.51 | 71.20 |
| | (13.31) | (14.24) | (11.27) | (14.48) |
| Streaming adoption | 0.581 | 0.568 | 0.602 | 0.581 |
| | (0.494) | (0.495) | (0.490) | (0.494) |
| Recorded live | 0.236 | 0.188 | 0.250 | 0.217 |
| | (0.413) | (0.379) | (0.416) | (0.399) |
| Num. of contributors to record | 11.38 | 10.06 | 10.29 | 10.45 |
| | (5.138) | (4.087) | (3.897) | (4.353) |
| Recorded in local lang. | 0.385 | 0.532 | 0.527 | 0.495 |
| | (0.468) | (0.482) | (0.489) | (0.485) |
| Performed by stars | 0.555 | 0.375 | 0.430 | 0.434 |
| | (0.480) | (0.476) | (0.480) | (0.483) |
| Library holdings | 55.52 | 55.65 | 72.63 | 60.20 |
| | (113.4) | (95.54) | (104.4) | (102.8) |
| Birth anniversary | 0.0349 | 0.0222 | 0.0200 | 0.0247 |
| | (0.184) | (0.148) | (0.140) | (0.155) |
| War death | 0.171 | 0.0281 | 0.392 | 0.161 |
| | (0.377) | (0.165) | (0.488) | (0.368) |
| Publication year (record) | 2010.7 | 2010.6 | 2011.2 | 2010.8 |
| | (4.934) | (4.984) | (4.669) | (4.893) |
| Recording age | 29.49 | 27.04 | 22.67 | 26.46 |
| | (21.76) | (22.20) | (20.40) | (21.76) |
| Recording year | 1976.6 | 1978.3 | 1983.7 | 1979.4 |
| | (22.12) | (21.58) | (20.52) | (21.60) |
| Copyright at recording | 0.627 | 0.0392 | 0.254 | 0.241 |
| | (0.465) | (0.185) | (0.429) | (0.419) |
| Observations | 3154 | | | |

*Notes* : Table shows means with standard deviations in parentheses. Statistics are based on a balanced panel of 2,042 operas.

**Natural experiment models**

Table 20: Copyright status and digital releases - Poisson model

| | (1) Digital | (2) Digital | (3) Digital | (4) Digital | (5) Digital | (6) Digital |
|---|---|---|---|---|---|---|
| Always PD | 0.325** | 0.295+ | 0.108 | 0.124 | 0.0754 | 0.118 |
| | (0.112) | (0.175) | (0.207) | (0.149) | (0.206) | (0.133) |
| Transitions | 0.322 | 0.307+ | 0.357* | 0.267 | 0.346* | 0.238 |
| | (0.198) | (0.182) | (0.141) | (0.171) | (0.164) | (0.182) |
| Controls | | Yes | Yes | Yes | Yes | Yes |
| Publication year FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Country FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Recording age FE | | | | Yes | | Yes |
| Recording year FE | | | Yes | | Yes | |
| Country-publication year FE | | | | | Yes | Yes |
| Observations | 6450 | 6450 | 6450 | 6450 | 5648 | 5648 |
| *AIC* | 4593.2 | 4554.8 | 3887.3 | 4482.4 | 3598.0 | 4096.2 |
| *BIC* | 4613.5 | 4636.1 | 3968.6 | 4563.7 | 3671.0 | 4169.2 |

Standard errors in parentheses

+ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

*Notes* : Sample covers operas that premiered from 1901 to 2002 and included records that are still under related rights protection. Standard errors are robust and clustered by composition, and composer. The coefficients of the treatment variables *always PD* and *transitions* are reported with respect to the baseline category *always copyright*. Control variables are: dummy that accounts for publication after Spotify adoption in a country, dummy for live performances, number of contributors, dummy for record being in the local language, dummy for records that include top performers, library holdings, dummy for records whose composers died during WW1 or WW2, copyright status at recording year, and dummy for important anniversaries of composer birth (25th, 50th, 75th, 100th, and 150th). The inclusion of country-publication year FE creates singleton and separated observations which are automatically dropped from Model 5 and Model 6.

Table 21: Copyright status and physical releases - Poisson model

| | (1) Physical | (2) Physical | (3) Physical | (4) Physical | (5) Physical | (6) Physical |
|---|---|---|---|---|---|---|
| Always PD | 0.151 | 0.132 | 0.0287 | 0.0145 | 0.0334 | -0.000387 |
| | (0.133) | (0.157) | (0.166) | (0.180) | (0.164) | (0.174) |
| Transitions | 0.251 | 0.189 | 0.112 | 0.172 | 0.124 | 0.161 |
| | (0.155) | (0.153) | (0.155) | (0.149) | (0.155) | (0.148) |
| Controls | | Yes | Yes | Yes | Yes | Yes |
| Publication year FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Country FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Recording age FE | | | | Yes | | Yes |
| Recording year FE | | | Yes | | Yes | |
| Country-publication year FE | | | | | Yes | Yes |
| Observations | 23764 | 23764 | 23762 | 23764 | 22537 | 22539 |
| *AIC* | 17661.2 | 17367.7 | 15810.6 | 17206.4 | 15221.5 | 16525.4 |
| *BIC* | 17685.5 | 17472.7 | 15915.6 | 17311.4 | 15317.8 | 16621.6 |

Standard errors in parentheses

$^{+}$ $p < 0.1$, $^{*}$ $p < 0.05$, $^{**}$ $p < 0.01$, $^{***}$ $p < 0.001$

*Notes* : Sample covers operas that premiered from 1901 to 2001 and included records that are still under related rights protection. Standard errors are robust and clustered by composition, and composer. The coefficients of the treatment variables *always PD* and *transitions* are reported with respect to the baseline category *always copyright*. Control variables are: dummy that accounts for publication after Spotify adoption in a country, dummy for live performances, number of contributors, dummy for record being in the local language, dummy for records that include top performers, library holdings, dummy for records whose composers died during WW1 or WW2, copyright status at recording year, and dummy for important anniversaries of composer birth (25th, 50th, 75th, 100th, and 150th). The inclusion of country-publication year FE creates singleton and separated observations which are automatically dropped from Model 5 and Model 6.

**Robustness: Estimator choice - OLS**

Table 22: Robustness: Copyright status and digital releases (OLS)

| | (1) Digital | (2) Digital | (3) Digital | (4) Digital | (5) Digital | (6) Digital |
|---|---|---|---|---|---|---|
| Always PD | 0.0396** | 0.0391 | 0.0269 | 0.0191 | 0.0310 | 0.0209 |
| | (0.0151) | (0.0238) | (0.0228) | (0.0211) | (0.0230) | (0.0205) |
| Transitions | 0.0488 | 0.0437 | 0.0502* | 0.0357 | 0.0433+ | 0.0283 |
| | (0.0301) | (0.0283) | (0.0219) | (0.0277) | (0.0245) | (0.0293) |
| Controls | | Yes | Yes | Yes | Yes | Yes |
| Publication year FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Country FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Recording age FE | | | | Yes | | Yes |
| Recording year FE | | | Yes | | Yes | |
| Country-publication year FE | | | | | Yes | Yes |
| Observations | 6450 | 6450 | 6450 | 6450 | 6418 | 6418 |
| *AIC* | 5487.1 | 5445.2 | 4924.5 | 5368.3 | 4483.9 | 4909.2 |
| *BIC* | 5507.4 | 5526.5 | 5005.8 | 5449.5 | 4565.1 | 4990.4 |

Standard errors in parentheses

$^{+}$ $p < 0.1$, $^{*}$ $p < 0.05$, $^{**}$ $p < 0.01$, $^{***}$ $p < 0.001$

*Notes* : Sample covers operas that premiered from 1901 to 2001 and included records that are still under related rights protection. Standard errors are robust and clustered by composition, and composer. The coefficients of the treatment variables *always PD* and *transitions* are reported with respect to the baseline category *always copyright*. Control variables are: dummy that accounts for publication after Spotify adoption in a country, dummy for live performances, number of contributors, dummy for record being in the local language, dummy for records that include top performers, library holdings, dummy for records whose composers died during WW1 or WW2, copyright status at recording year, and dummy for important anniversaries of composer birth (25th, 50th, 75th, 100th, and 150th). The inclusion of country-publication year FE creates singleton and separated observations which are automatically dropped from Model 5 and Model 6.

Table 23: Robustness: Copyright status and physical releases (OLS)

| | (1) Physical | (2) Physical | (3) Physical | (4) Physical | (5) Physical | (6) Physical |
|---|---|---|---|---|---|---|
| Always PD | 0.0197 | 0.0184 | 0.0108 | 0.00507 | 0.0101 | 0.00496 |
| | (0.0170) | (0.0216) | (0.0242) | (0.0250) | (0.0230) | (0.0240) |
| Transitions | 0.0336 | 0.0251 | 0.0152 | 0.0205 | 0.0148 | 0.0191 |
| | (0.0208) | (0.0219) | (0.0234) | (0.0216) | (0.0234) | (0.0216) |
| Controls | | Yes | Yes | Yes | Yes | Yes |
| Publication year FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Country FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Recording age FE | | | | Yes | | Yes |
| Recording year FE | | | Yes | | Yes | |
| Country-publication year FE | | | | | Yes | Yes |
| Observations | 23764 | 23764 | 23762 | 23764 | 23741 | 23743 |
| *AIC* | 24849.6 | 24589.8 | 23276.6 | 24442.2 | 22486.5 | 23611.3 |
| *BIC* | 24873.8 | 24694.8 | 23381.6 | 24547.2 | 22591.4 | 23716.3 |

Standard errors in parentheses

$^{+}$ $p < 0.1$, $^{*}$ $p < 0.05$, $^{**}$ $p < 0.01$, $^{***}$ $p < 0.001$

*Notes* : Sample covers operas that premiered from 1901 to 2001 and included records that are still under related rights protection. Standard errors are robust and clustered by composition, and composer. The coefficients of the treatment variables *always PD* and *transitions* are reported with respect to the baseline category *always copyright*. Control variables are: dummy that accounts for publication after Spotify adoption in a country, dummy for live performances, number of contributors, dummy for record being in the local language, dummy for records that include top performers, library holdings, dummy for records whose composers died during WW1 or WW2, copyright status at recording year, and dummy for important anniversaries of composer birth (25th, 50th, 75th, 100th, and 150th). The inclusion of country-publication year FE creates singleton and separated observations which are automatically dropped from Model 5 and Model 6.

**Robustness: restricted sample**

Table 24: Author rights sample summary statistics: digital releases (restricted sample)

| | Mean | SD | Min | Max |
|---|---|---|---|---|
| Digital release | .1290323 | .3359136 | 0 | 1 |
| Premiere year (composition) | 1916.851 | 14.17037 | 1902 | 1942 |
| Age at death | 69.83871 | 15.34377 | 39 | 89 |
| Streaming adoption | .6733871 | .4699227 | 0 | 1 |
| Recorded live | .1895161 | .3927106 | 0 | 1 |
| Num. of contributors to record | 13.0121 | 4.879505 | 6 | 25 |
| Recorded in local lang. | .5241935 | .5004243 | 0 | 1 |
| Performed by stars | .8346774 | .3722226 | 0 | 1 |
| Library holdings | 173.4476 | 101.0515 | 2 | 311 |
| Birth anniversary | .0645161 | .2461669 | 0 | 1 |
| War death | .0443548 | .2062986 | 0 | 1 |
| Publication year (record) | 2011.198 | 3.915772 | 2003 | 2017 |
| Recording age | 48.90323 | 5.70378 | 40 | 65 |
| Recording year | 1957.512 | 5.433426 | 1941 | 1964 |
| Observations | 248 | | | |

*Notes* : Statistics are based on a balanced panel of 33 opera records.

Table 25: Author rights sample summary statistics: physical releases (restricted sample)

| | Mean | SD | Min | Max |
|---|---|---|---|---|
| Physical release | .0874317 | .2825181 | 0 | 1 |
| Premiere year (composition) | 1916.764 | 11.71863 | 1901 | 1948 |
| Age at death | 72.24991 | 11.63463 | 39 | 96 |
| Streaming adoption | .568306 | .4954026 | 0 | 1 |
| Recorded live | .1836066 | .3872335 | 0 | 1 |
| Num. of contributors to record | 10.86812 | 4.651729 | 1 | 28 |
| Recorded in local lang. | .4225865 | .4940608 | 0 | 1 |
| Performed by stars | .6444444 | .4787685 | 0 | 1 |
| Library holdings | 14.06193 | 41.54616 | 0 | 239 |
| Birth anniversary | .0459016 | .2093099 | 0 | 1 |
| War death | .1114754 | .3147773 | 0 | 1 |
| Publication year (record) | 2011.353 | 4.593483 | 2000 | 2018 |
| Recording age | 51.56976 | 7.876389 | 37 | 99 |
| Recording year | 1953.495 | 7.915097 | 1902 | 1964 |
| Observations | 2745 | | | |

*Notes* : Statistics are based on a balanced panel of 217 opera records.

Table 26: Author rights sample summary statistics: digital releases by treatment (restricted sample)

| | Always PD | Always copyright | Transitions | Total |
|---|---|---|---|---|
| Digital release | 0.135 | 0.118 | 0.136 | 0.129 |
| | (0.343) | (0.325) | (0.351) | (0.336) |
| Premiere year (composition) | 1909.1 | 1924.5 | 1931.1 | 1916.9 |
| | (7.663) | (15.74) | (7.292) | (14.17) |
| Age at death | 64.19 | 84.09 | 43.77 | 69.84 |
| | (10.56) | (6.312) | (9.008) | (15.34) |
| Streaming adoption | 0.789 | 0.484 | 0.773 | 0.673 |
| | (0.409) | (0.502) | (0.429) | (0.470) |
| Recorded live | 0.0977 | 0.301 | 0.273 | 0.190 |
| | (0.298) | (0.461) | (0.456) | (0.393) |
| Num. of contributors to record | 14.20 | 11.02 | 14.23 | 13.01 |
| | (5.385) | (2.216) | (6.941) | (4.880) |
| Recorded in local lang. | 0.331 | 0.742 | 0.773 | 0.524 |
| | (0.472) | (0.440) | (0.429) | (0.500) |
| Performed by stars | 0.842 | 0.903 | 0.500 | 0.835 |
| | (0.366) | (0.297) | (0.512) | (0.372) |
| Library holdings | 152.9 | 179.3 | 272.8 | 173.4 |
| | (111.7) | (78.67) | (37.08) | (101.1) |
| Birth anniversary | 0.0677 | 0.0753 | 0 | 0.0645 |
| | (0.252) | (0.265) | (0) | (0.246) |
| War death | 0.0827 | 0 | 0 | 0.0444 |
| | (0.276) | (0) | (0) | (0.206) |
| Publication year (record) | 2011.5 | 2010.6 | 2012.0 | 2011.2 |
| | (3.779) | (4.118) | (3.658) | (3.916) |
| Recording age | 51.51 | 45.23 | 48.68 | 48.90 |
| | (5.328) | (3.672) | (6.491) | (5.704) |
| Recording year | 1955.4 | 1960.2 | 1959.0 | 1957.5 |
| | (5.641) | (3.866) | (4.434) | (5.433) |
| Observations | 248 | | | |

*Notes* : Table shows means with standard deviations in parentheses. Statistics are based on a balanced panel of 33 opera records.

Table 27: Author rights sample summary statistics: physical releases by treatment (restricted sample)

| | Always PD | Always copyright | Transitions | Total |
|---|---|---|---|---|
| Physical release | 0.0897 | 0.0857 | 0.0863 | 0.0874 |
| | (0.286) | (0.280) | (0.281) | (0.283) |
| Premiere year (composition) | 1911.5 | 1921.2 | 1918.6 | 1916.8 |
| | (8.610) | (11.71) | (13.02) | (11.72) |
| Age at death | 68.75 | 79.21 | 64.27 | 72.25 |
| | (8.574) | (11.40) | (9.230) | (11.63) |
| Streaming adoption | 0.596 | 0.524 | 0.606 | 0.568 |
| | (0.491) | (0.500) | (0.489) | (0.495) |
| Recorded live | 0.196 | 0.197 | 0.127 | 0.184 |
| | (0.397) | (0.398) | (0.333) | (0.387) |
| Num. of contributors to record | 11.47 | 10.71 | 9.880 | 10.87 |
| | (4.997) | (4.499) | (3.949) | (4.652) |
| Recorded in local lang. | 0.386 | 0.463 | 0.414 | 0.423 |
| | (0.487) | (0.499) | (0.493) | (0.494) |
| Performed by stars | 0.752 | 0.594 | 0.520 | 0.644 |
| | (0.432) | (0.491) | (0.500) | (0.479) |
| Library holdings | 12.62 | 13.54 | 18.46 | 14.06 |
| | (42.48) | (39.07) | (44.59) | (41.55) |
| Birth anniversary | 0.0583 | 0.0424 | 0.0261 | 0.0459 |
| | (0.234) | (0.202) | (0.160) | (0.209) |
| War death | 0.115 | 0.0168 | 0.319 | 0.111 |
| | (0.319) | (0.129) | (0.467) | (0.315) |
| Publication year (record) | 2011.4 | 2011.2 | 2011.7 | 2011.4 |
| | (4.507) | (4.755) | (4.397) | (4.593) |
| Recording age | 50.70 | 53.29 | 49.62 | 51.57 |
| | (7.046) | (9.069) | (5.644) | (7.876) |
| Recording year | 1954.6 | 1951.3 | 1955.9 | 1953.5 |
| | (6.985) | (9.213) | (4.945) | (7.915) |
| Observations | 2745 | | | |

*Notes* : Table shows means with standard deviations in parentheses. Statistics are based on a balanced panel of 217 opera records.

Table 28: Copyright status and digital releases - Poisson model (restricted sample)

| | (1) Digital | (2) Digital | (3) Digital | (4) Digital | (5) Digital | (6) Digital |
|---|---|---|---|---|---|---|
| Always PD | 0.830*** | 0.893* | 0.0341 | 0.0712 | 0.202 | 0.162 |
| | (0.210) | (0.372) | (0.122) | (0.966) | (0.231) | (0.640) |
| Transitions | 0.874*** | 1.464*** | -2.925 | 0.612 | -3.054 | 0.908+ |
| | (0.260) | (0.377) | (2.021) | (0.868) | (2.141) | (0.472) |
| Controls | | Yes | Yes | Yes | Yes | Yes |
| Publication year FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Country FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Recording age FE | | | | Yes | | Yes |
| Recording year FE | | | Yes | | Yes | |
| Country-publication year FE | | | | | Yes | Yes |
| Observations | 248 | 248 | 234 | 248 | 142 | 149 |
| *AIC* | 166.9 | 171.6 | 140.2 | 166.4 | 112.9 | 138.6 |
| *BIC* | 177.4 | 210.3 | 174.8 | 201.6 | 133.6 | 165.6 |

Standard errors in parentheses

+ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

*Notes* : Sample covers operas that premiered from 1901 to 1948. Standard errors are robust and clustered by record, composition, and composer. The coefficients of the treatment variables *always PD* and *transitions* are reported with respect to the baseline category *always copyright*. Control variables are: dummy that accounts for publication after Spotify adoption in a country, dummy for live performances, number of contributors, dummy for record being in the local language, dummy for records that include top performers, library holdings, dummy for records whose composers died during WW1 or WW2, and dummy for important anniversaries of composer birth (25th, 50th, 75th, 100th, and 150th). The inclusion of country-publication year FE creates singleton and separated observations which are automatically dropped from Model 5 and Model 6.

Table 29: Copyright status and physical releases - Poisson model (restricted sample)

| | (1) Physical | (2) Physical | (3) Physical | (4) Physical | (5) Physical | (6) Physical |
|---|---|---|---|---|---|---|
| Always PD | 0.0301 | -0.0295 | -0.223 | 0.113 | -0.261 | 0.0815 |
| | (0.122) | (0.113) | (0.204) | (0.141) | (0.168) | (0.125) |
| Transitions | 0.157 | 0.0849 | -0.125 | 0.293$^{+}$ | -0.0415 | 0.338$^{**}$ |
| | (0.187) | (0.204) | (0.254) | (0.167) | (0.220) | (0.125) |
| Controls | | Yes | Yes | Yes | Yes | Yes |
| Publication year FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Country FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Recording age FE | | | | Yes | | Yes |
| Recording year FE | | | Yes | | Yes | |
| Country-publication year FE | | | | | Yes | Yes |
| Observations | 2745 | 2745 | 2745 | 2745 | 1836 | 1836 |
| *AIC* | 1363.9 | 1359.3 | 1316.6 | 1312.4 | 1188.4 | 1186.8 |
| *BIC* | 1381.7 | 1430.3 | 1387.6 | 1383.4 | 1249.1 | 1247.5 |

Standard errors in parentheses

$^{+}$ $p < 0.1$, $^{*}$ $p < 0.05$, $^{**}$ $p < 0.01$, $^{***}$ $p < 0.001$

*Notes* : Sample covers operas that premiered from 1901 to 1948. Standard errors are robust and clustered by record, composition, and composer. The coefficients of the treatment variables *always PD* and *transitions* are reported with respect to the baseline category *always copyright*. Control variables are: dummy that accounts for publication after Spotify adoption in a country, dummy for live performances, number of contributors, dummy for record being in the local language, dummy for records that include top performers, library holdings, dummy for records whose composers died during WW1 or WW2, and dummy for important anniversaries of composer birth (25th, 50th, 75th, 100th, and 150th). The inclusion of country-publication year FE creates singleton and separated observations which are automatically dropped from Model 5 and Model 6.

# Online Appendix

Table 30: EU Directive 2011/77 - Adoption year by EU Member State

| **Country** | **Adoption year** |
|---|---|
| Austria | 2016 |
| Belgium | 2014 |
| Bulgaria | 2014 |
| Croatia | 2013 |
| Cyprus | 2014 |
| Czech Republic | 2013 |
| Denmark | 2014 |
| Estonia | 2017 |
| Finland | 2015 |
| France | 2015 |
| Germany | 2014 |
| Greece | 2013 |
| Hungary | 2014 |
| Ireland | 2013 |
| Italy | 2014 |
| Latvia | 2014 |
| Lithuania | 2014 |
| Luxembourg | 2015 |
| Malta | 2014 |
| The Netherlands | 2015 |
| Poland | 2016 |
| Portugal | 2013 |
| Romania | 2015 |
| Slovakia | 2017 |
| Slovenia | 2016 |
| Spain | 2015 |
| Sweden | 2013 |
| United Kingdom | 2013 |

Table 31: Top 15 composers in recording publications

| **Composer** | **Freq.** | **Percent** |
|---|---|---|
| Giuseppe Verdi | 759 | 9.62 |
| Richard Wagner | 696 | 8.82 |
| Wolfgang Amadeus Mozart | 683 | 8.66 |
| Giacomo Puccini | 279 | 3.54 |
| Richard Strauss | 260 | 3.30 |
| George Frideric Handel | 259 | 3.28 |
| Gaetano Donizetti | 240 | 3.04 |
| Gioacchino Rossini | 195 | 2.47 |
| Antonio Vivaldi | 130 | 1.65 |
| Jules Massenet | 119 | 1.51 |
| Vincenzo Bellini | 117 | 1.48 |
| Ludwig van Beethoven | 106 | 1.34 |
| Georges Bizet | 102 | 1.39 |
| Benjamin Britten | 101 | 1.28 |
| Christoph Willibald Gluck | 87 | 1.10 |

Table 32: Top orchestras

| | |
|---|---|
| Academy of St Martin in the Fields | Norddeutscher Rundfunk |
| Accademia di Santa Cecilia | Opera de Lyon |
| Ambrosian Opera Chorus | Opera de Paris |
| Ambrosian Singers | Orchestra of the Age of Enlightenment |
| Bayerische Staatsoper München | Orchestra Sinfonica della Rai (Radiotelevisione Italiana) |
| Bayerischer Rundfunk | Orchestra Sinfonica di Milano |
| BBC Symphony Orchestra | Orchestra Sinfonica di Roma |
| Berliner Philharmoniker | Orchestra Sinfonica di Torino |
| Berliner Rundfunk | Orchestre Philharmonique de Radio France |
| Coro di Roma | Peter Moores Foundation |
| Coro di Torino | Philharmonia Chorus |
| Deutsche Oper Berlin | Philharmonia Orchestra |
| D'Oyly Carte Opera Company | Rias-Kammerchor |
| English Chamber Orchestra | Royal Opera House |
| Geoffrey Mitchell Choir | Royal Philharmonic Orchestra |
| Glyndebourne Festival Chorus | Rundfunkchor Leipzig |
| John Alldis Choir | Scottish Chamber Orchestra |
| Konzertvereinigung Wiener Staatsopernchor | Slovenskà Filharmònia |
| London Philharmonic Orchestra | Société des Concerts du Conservatoire |
| London Symphony Chorus | Staatskapelle Berlin |
| London Symphony Orchestra | Staatskapelle Dresden |
| London Voices | Teatro alla Scala |
| Maggio Musicale Fiorentino | Teatro dell'Opera |
| Münchner Rundfunkorchester | Teatro di San Carlo |
| Musiciens du Louvre | Wiener Philharmoniker |
| New Philharmonia Orchestra | |

Table 33: Top conductors and performers

| | |
|---|---|
| Alan Curtis | José Carreras |
| Alastair Miles | José Van Dam |
| Alberto Erede | Josef Greindl |
| Alfredo Kraus | Joyce Didonato |
| André Previn | Jussi Bjèorling |
| Andrea Bocelli | Karl Bèohm |
| Angela Gheorghiu | Kiri Te Kanawa |
| Anna Moffo | Kirsten Flagstad |
| Anna Netrebko | Kurt Moll |
| Anne Sofie Von Otter | Lamberto Gardelli |
| Anneliese Rothenberger | Leonard Warren |
| Anthony Rolfe Johnson | Leontyne Price |
| Anton Dermota | Lorin Maazel |
| Antonino Votto | Lucia Popp |
| Antonio Pappano | Luciano Pavarotti |
| Arturo Toscanini | Luigi Alva |
| Astrid Varnay | Marc Minkowski |
| Beverly Sills | Marco Armiliato |
| Birgit Nilsson | Maria Callas |
| Boris Christoff | Marilyn Horne |
| Brigitte Fassbaender | Mario Del Monaco |
| Bruce Ford | Mirella Freni |
| Bryn Terfel | Montserrat Caballé |
| Carlo Bergonzi | Natalie Dessay |
| Carlo Maria Giulini | Neville Marriner |
| Cecilia Bartoli | Nicola Rescigno |
| Cesare Siepi | Nicola Zaccaria |
| Charles Mackerras | Nicolai Gedda |
| Christa Ludwing | Nicolai Ghiaurov |
| Christophe Rousset | Otto Klemperer |
| Claudio Abbado | Paolo Tosti |
| Colin Davis | Patrizia Ciofi |
| Daniel Barenboim | Peter Schreier |
| David Parry | Philippe Jaroussky |
| Dietrich Fischer-Dieskau | Piero Cappuccilli |
| Eberhard Wèachter | Piero De Palma |
| Elisabeth Schwarzkopf | Placido Domingo |
| Erich Kunz | Renata Scotto |
| Erich Leinsdorf | Renata Tebaldi |
| Erich Wolfgang Korngold | Renato Bruson |
| Fabio Luisi | René Jacobs |
| Fedora Barbieri | Renée Fleming |
| Ferenc Fricsay | Riccardo Chailly |
| Fernando Corena | Riccardo Muti |
| Fiorenza Cossotto | Richard Bonynge |
| Francesco Molinari-Pradelli | Richard Hickox |
| Franco Corelli | Rita Streich |
| Frederica Von Stade | Robert Lloyd |
| Fritz Kreisler | Robert Merrill |
| Furtwèangler Wilhelm | Robert Tear |
| Georg Solti | Roberto Alagna |
| George London | Rolando Paneari |
| Georges Prêtre | Rolando Villazòn |
| Gianandrea Noseda | Ruggero Raimondi |
| Giulietta Simionato | Samuel Ramey |
| Giuseppe Di Stefano | Sandrine Piau |
| Giuseppe Taddei | Sara Mingardo |
| Gottlob Frick | Sena Jurinac |
| Hanks Hotter | Sesto Bruscantini |
| Heitor Villa-Lobos | Sherril Milnes |
| Herbert Von Karajan | Simon Rattle |
| Hermann Prey | Sonia Prina |
| Ileana Cotrubas | Teresa Berganza |
| James Levine | Theo Adam |
| Jason Robert Brown | Thomas Allen |
| Jennifer Larmore | Thomas Beecham |
| Jessye Norman | Thomas Hampson |
| Joan Sutherland | Tito Gobbi |
| John Eliot Gardiner | Tullio Serafin |
| John Philip Sousa | Véronique Gens |
| John Tomlinson | Victoria De Los Angeles |
| Jon Vickers | Walter Berry |
| José Carreras | Wiener Staatsoper |
| José Van Dam | Wolfgang Sawallisch |
| Josef Greindl | Wolfgang Windgassen |
| Joyce Didonato | Zubin Mehta |

Table 34: Copyright status and physical re-releases - Top performers interaction

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| Public Domain (Recording) | 0.2125** | 0.4062*** | 0.3644*** | 0.5476*** |
| | (0.0692) | (0.1079) | (0.0977) | (0.1236) |
| Public Domain (Recording) × | | | | |
| Top Performers | -0.0081 | -0.0752 | -0.0466 | -0.1329 |
| | (0.0537) | (0.0807) | (0.0567) | (0.0848) |
| Controls | Yes | Yes | Yes | Yes |
| Publication Year FE | Yes | Yes | Yes | Yes |
| Country FE | Yes | Yes | Yes | Yes |
| Composer FE | Yes | | Yes | |
| Opera FE | | Yes | | Yes |
| Recording Age FE | | | Yes | Yes |
| Recording Year FE | | | Yes | Yes |
| Country-Publication Year FE | | | Yes | Yes |
| N | 107,481 | 107,481 | 107,473 | 107,481 |
| AIC | 50,226.83 | 49,852.40 | 48,846.16 | 48,402.11 |
| BIC | 50,341.85 | 49,967.42 | 48,961.18 | 48,517.13 |

*Notes* : Significance: *** p<0.001, ** p<0.01, * p<0.05. Standard errors are clustered at the opera-composer-country release recordings group. Coefficients are computed using the pseudo-maximum likelihood model with multi-way fixed effects. Dependent variable: counter of physical re-release of opera recordings. Control variables include: dummy for live recordings; recording contributors; $25^{th}$ death and birth opera composer anniversaries; recording-country equal language;top performers/orchestras/conductors indicator, dummy for the composer public domain status at the recording year.

Table 35: Copyright status and physical re-releases (Top performers interaction) - Linear Model

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| Public Domain (Recording) | 0.0130** | 0.0255*** | 0.0213*** | 0.0322*** |
| | (0.0043) | (0.0070) | (0.0063) | (0.0081) |
| Public Domain (Recording) × | | | | |
| Top Performers | -0.0007 | -0.0052 | -0.0025 | -0.0078 |
| | (0.0033) | (0.0054) | (0.0035) | (0.0058) |
| Controls | Yes | Yes | Yes | Yes |
| Publication Year FE | Yes | Yes | Yes | Yes |
| Country FE | Yes | Yes | Yes | Yes |
| Composer FE | Yes | | Yes | |
| Opera FE | | Yes | | Yes |
| Recording Age FE | | | Yes | Yes |
| Recording Year FE | | | Yes | Yes |
| Country-Publication Year FE | | | Yes | Yes |
| N | 107,481 | 107,481 | 107,481 | 107,481 |
| R-squared | 0.01 | 0.01 | 0.03 | 0.03 |

*Notes* : Significance: *** p<0.001, ** p<0.01, * p<0.05. Standard errors are clustered at the opera-composer-country release recordings group. Dependent variable: counter of physical re-release of opera recordings. Coefficients are computed using the linear regression with multi-way fixed effects. Control variables include: dummy for live recordings; recording contributors; $25^{th}$ death and birth opera composer anniversaries; recording-country equal language;top performers/orchestras/conductors indicator, dummy for the composer public domain status at the recording year.

Table 36: Copyright status and digital re-releases - Top performers interaction

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| Public Domain (Recording) | 0.0103 | 0.0197 | 0.0125 | 0.0338 |
| | (0.0148) | (0.0239) | (0.0197) | (0.0264) |
| Public Domain (Recording) × | | | | |
| Top Performers | -0.0051 | -0.0135 | -0.0057 | -0.0236 |
| | (0.0096) | (0.0174) | (0.0146) | (0.0222) |
| Controls | Yes | Yes | Yes | Yes |
| Publication Year FE | Yes | Yes | Yes | Yes |
| Country FE | Yes | Yes | Yes | Yes |
| Composer FE | Yes | | Yes | |
| Opera FE | | Yes | | Yes |
| Recording Age FE | | | Yes | Yes |
| Recording Year FE | | | Yes | Yes |
| Country-Publication Year FE | | | Yes | Yes |
| N | 28,234 | 28,234 | 28,234 | 28,234 |
| R-squared | 0.01 | 0.01 | 0.03 | 0.04 |

*Notes* : Significance: *** p<0.001, ** p<0.01, * p<0.05. Standard errors are clustered at the opera-composer-country release recordings group. Dependent variable: dummy variable equal 1 in case of digital re-release, 0 otherwise. Coefficients are computed using the linear regression with multi-way fixed effects. Control variables include: dummy for live recordings; recording contributors; $25^{th}$ death and birth opera composer anniversaries; recording-country equal language;top performers/orchestras/conductors indicator, dummy for the composer public domain status at the recording year.

Table 37: Copyright status and digital re-releases (Top performers interaction) - Logit model

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| Public Domain (Recording) | 0.1357 | 0.3175 | 0.1879 | 0.5255 |
| | (0.3741) | (0.4814) | (0.4431) | (0.5292) |
| Public Domain (Recording) × | | | | |
| Top Performers | -0.0765 | -0.2813 | -0.1075 | -0.4210 |
| | (0.3030) | (0.4196) | (0.3852) | (0.4684) |
| Controls | Yes | Yes | Yes | Yes |
| Country FE | Yes | Yes | Yes | Yes |
| Opera FE | | Yes | | Yes |
| Composer FE | Yes | | Yes | |
| Recording Age FE | | | Yes | Yes |
| Recording Year FE | | | Yes | Yes |
| Publication Year FE | | | Yes | Yes |
| Country-Publication Year FE | Yes | Yes | Yes | Yes |
| N | 28,272 | 28,272 | 26,958 | 26,958 |
| Pseudo R-squared | 0.02 | 0.03 | 0.06 | 0.06 |

*Notes* : Significance: *** p<0.001, ** p<0.01, * p<0.05. Standard errors are clustered at the opera-composer-country release recordings group. Dependent variable: dummy variable equal 1 in case of digital re-release, 0 otherwise. Coefficients are computed using the logit model with multi-way fixed effects. Control variables include: dummy for live recordings; recording contributors; $25^{th}$ death and birth opera composer anniversaries; recording-country equal language;top performers/orchestras/conductors indicator, dummy for the composer public domain status at the recording year.

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