Copyright Duration and the Supply of Creative Work:
Evidence from the Movies

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Abstract

At various dates between 1991-2002, nineteen OECD countries extended the term of copyright, typically from the author's life plus 50 years to author's life plus 70 years. We study the impact of the extensions on the production of movies.

We find that the extensions were associated with an increase in movie production ranging between 8.51% (±4.60%) and 10.4% (±4.89%). The increase was higher in countries where piracy was lower.

These findings were robust to various specifications, including concomitant changes in government funding of movie production.

The copyright term extension applied retrospectively to owners of existing film libraries and might have reduced their cost of capital. However, studios with larger libraries did not increase movie production relatively more than smaller studios.

Our results suggest that contrary to received thinking among leading economists and lawyers, extensions of copyright term far in the future did have economically significant effects on the production of movies.

1. Introduction

Generally, copyright law must strike a delicate balance between two considerations:

- Broader and longer protection increases the return to creators of new work, and in the long term, encourages more creative work;
- Narrower and shorter protection increases the use of existing creative work, and hence, raises the benefit to end-users and also facilitates new creations that build upon earlier work. [1]

There is no disagreement about the directions of these two considerations (Plant 1934; Nordhaus 1969; Gallini and Scotchmer 2002). However, debate on the trade-off has been controversial. Many scholars argue that the scope and term of copyright were (are) already excessive (Hurt and Schuchman 1966; Lessig 2001; Boldrin and Levine 2002). Others argue in favor of more protection (Landes and Posner 1989; Miller 1995).

Within the debate on copyright law, a key issue is the impact of copyright law on the production of creative work. Effective 1995, the European Union extended the term of copyright from author's life plus 50 years to author's life plus 70 years. Other European countries – members of the European Free Trade Area and applicants to join the EU – also extended copyright term. In 1998, the United States followed and passed the Sonny Bono Copyright Term Extension Act (CTEA).

In 2002, the U.S. Supreme Court heard the *Eldred* case, which challenged the CTEA.[2] Seventeen distinguished economists, including five Nobel laureates, filed an *amici curiae* brief against the CTEA (Akerlof et al. 2002). The brief noted that, in present value terms, a 20-year increase in copyright term from author's life plus 50 years to author's life plus 70 years provided a very small return. Hence, the brief concluded that, "The CTEA's longer copyright for new works provides at most a very small additional incentive" for creation of new works. Further, the brief argued against the *retrospective* extension of term to works already in existence.

In a trenchant criticism, Liebowitz and Margolis (2005) argued that Akerlof et al. (2002) had skirted the central issue: "The present value of additional revenues to authors might be heavily discounted (and small), but this need not imply that the impact of these revenues on the creation of works is small ... The change in the number of new titles

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[1] An alternative is to replace intellectual property rights with a system of rewards for inventors and creators (Shavell and van Ypersele 2001).

[2] Eric Eldred et al., v. John D. Ashcroft, Attorney General, U.S. Supreme Court, No. 01-618.

depends on the additional reward received by authors and on the elasticity of creation with respect to reward" (pp. 443, 445-446). They noted that, of a sample of 236 titles reviewed by *Book Review Digest* in the 1920s, 41% were still in print 58 years later. [3]

The controversies continue to rage in part because there has been very little systematic empirical evidence on either the long-term impact of copyright on the creation of new work or the short-term impact on the use and re-use of existing work. "In the formation of copyright policy, the lack of empirical data and the inability to quantify important variables … preclude precise evaluation of the impact of any significant changes in the degree of copyright protection" (Bard and Kurlantzick (1999) page 3).

In this paper, we study a panel of twenty-six OECD countries over the period 1991-2002. During this time, twenty countries extended the term of copyright, typically from author's life plus 50 years to author's life plus 70 years. We use the panel to address the key policy question: By exactly how much does an increase in copyright term affect the creation of new work, specifically, movies?

We find that, on average, the copyright term extension was associated with an increase in movie production ranging between 8.51% (±4.60%) and 10.4% (±4.89%). Importantly, the increase in production was higher in countries with lower rates of piracy.

These findings were robust to various specifications. We measured the number of movie titles in two different ways – one adjusting for co-production among countries and the other excluding co-productions. In a sub-sample of several European countries, we included government funding of movie production, and still found that the copyright term extension was associated with higher movie production.

The extensions of copyright term applied retrospectively and hence enriched studios with existing film libraries. With increased capital, these studios might have responded by investing in more movies. However, we found that studios with larger

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[3] Landes and Posner (1989) offered a different justification for the copyright term extension: "a long trend toward lengthening the term of copyright … is consistent with the fact that the cost of copying has fallen over this period" (page 363). By implication, the copyright term extension serves to compensate authors for income lost to improved copying technologies.

[5] Baker and Cunningham (2004) conducted an event study of changes in U.S. copyright law on the stock-market value of companies in copyright-related industries. They considered both case and statutory law, and found that increases in copyright protection were associated with an average US$4 - 8.4 million increase in the market value of these companies.

libraries did not increase movie production relatively more than smaller studios.

Our results suggest that contrary to received thinking among leading economists and lawyers, extensions of copyright term far in the future did have economically significant effects on the production of movies.

2. Previous Research

Surprisingly, despite the persistent controversy, there has been little empirical study of the impact of copyright on the production of creative work. The little extant work mostly provides only indirect evidence. We first review research into the impact of copyright term on creators' earnings.

Under U.S. law, registration of copyright is not mandatory. However, the law provides an incentive for registration, as the owner must register (or, under the 1976 Copyright Act, apply to register) before the infringement or within three months of first publication if the owner seeks statutory damages and attorney fees.

Rappaport (1998) studied the commercial value in 1998 of movies first copyrighted in the period 1922-1941. He found two trends. More recently created movies were more likely to be still played commercially: the rate of commercial survival was 11% among movies created in 1926-1928, 40% among movies created in 1929-1932, and 65%, among movies created in 1933-1941. Further, more recently created movies were relatively more valuable: the average commercial value was $175,000 among movies created in 1926-1930, $250,000 among movies created in 1931-1934, and $400,000 among movies created in 1935-1941.

Landes and Posner (2003) studied the pattern of renewals of registration with the U.S. Copyright Office during the period 1910-91. Until 1962, renewals were effective for an additional 28 years, while from 1962, the renewal was for 47 years. Generally, the renewal rate increased from a low of 3% in 1914 to a high of 22% in 1991, and the renewal rate was highest for music, lower for books, and lowest for graphic-arts works. Assuming that works were not renewed because the expected future earnings fell below the cost of renewal ($10 plus the time and effort), Landes and Posner (2003) concluded that almost 80% of copyrighted works had little economic value after the initial term.

By contrast, Liebowitz and Margolis (2005) studied a sample of 236 titles reviewed by *Book Review Digest* in the 1920s. Fifty-eight years later, 41% were still in print.

In assessing the value of copyright protection, it is important to note that, at the point in time where the creator incurs the cost of creative effort, she will not know whether her work will turn into a blockbuster. Hence, copyright and copyright registration should be valued as real options rather than absolute amounts.[5]

Second, we review research into the creators' elasticity of supply. For most of the 19th century, U.S. copyright law did not protect British authors. Then, in 1891, Congress passed the International Copyright Act, which extended copyright protection to foreign authors, and through reciprocal recognition, extended international copyright protection to U.S. authors. However, passage of the Act did not substantially affect the number of full-time authors in the United States (Khan 2004). [6]

Hui and Png (2002) studied the impact of the CTEA on U.S. production of movies. They found that the CTEA had a positive but insignificant effect. However, consultants to the motion picture industry criticized this study on two grounds: "relies upon such a small sample (11 years), with only two after the extension" and "ignores the significant lead time that movies require before production, and hence is likely to understate the incentives in the initial years after extension" (Allen Consulting Group (2003), page 27).

Landes and Posner (2003) studied the impact of the 1962 extension of copyright term and the 1998 CTEA on all U.S. copyright registrations between 1910 and 2000. They found that both changes had positive but insignificant effects: "It is not surprising that the term-extension variables (in 1962 and 1998) are insignificant; the expected commercial life of a copyrighted work is so much shorter than the copyright term that it makes a lengthening of the term irrelevant to most potential registrants" (Landes and Posner (2003), page 247). Three categories accounted for 70 percent of all registrations with the Copyright Office – books, music, and graphic arts. As noted above, these three categories varied in their expected commercial life. Further, as already mentioned, copyright registration is not compulsory.

Accordingly, the impact of copyright protection generally and the term of copyright specifically on the creation of new work continues to be an open question.

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[6] An important margin on which copyright law affects the supply of creative work is that between part- and full-time creative activity (Liebowitz and Margolis 2005). Towse (2001) observed that that: "Estimates suggest artists' elasticity of supply to arts work is high and so a relatively small financial reward … can have a greater than proportionate impact on creativity". Unfortunately, no empirical evidence was provided.

3. Context

The Berne Convention specifies minimum durations of copyright as follows: [7]

> "(1) The term of protection granted by this Convention shall be the life of the author and fifty years after his death.
>
> (2) However, in the case of cinematographic works, the countries of the Union may provide that the term of protection shall expire fifty years after the work has been made available to the public with the consent of the author, or, failing such an event within fifty years from the making of such a work, fifty years after the making."

On October 29, 1993, the Council of the European Union issued Directive 93/98/CEE to harmonize the term of exclusivity in copyright and related rights with effect from July 1, 1995. [8] In the case of literary, dramatic, musical and artistic works, the Directive specified a term of author's life plus 70 years. In the case of audiovisual works, the Directive specified a term of 70 years following the death of the last survivor among the principal director, the screenplay and dialogue authors, and the music composer. Significantly, the extension of term applied *retroactively* to any existing work with copyright still in force.

At the time of the Directive, the copyright laws of Austria and Germany specified duration of the author's life plus 70 years, which was the longest among the European Union (EU) member states. The Union decided to increase the term elsewhere to match the copyright term in Austria and Germany. Politically, this was the most convenient choice (Dworkin 1993). At various times between 1994-1997, the European Union member states revised their copyright laws to conform with the Directive.

The EU Directive had a broader impact, beyond the EU member states. Notably, pursuant to the Agreement on the European Economic Area of May 2, 1992, member states of the European Free Trade Area (EFTA) had to conform with the EU (Gotzen 1998). [9] In addition, the various Central and East European countries seeking admission to the EU, such as the Czech Republic, Hungary, Poland, and Slovakia, also had to conform.

Further, the United States also aligned its copyright term with the European Union. In 1998, Congress passed the Sonny Bono Copyright Term Extension Act (CTEA),

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[7] Berne Convention for the Protection of Literary and Artistic Works (Paris Text 1971).

[8] Directive 93/98, *OJ* No. L 290 of 24 November 1993.

[9] Agreement on the European Economic Area of 2 May 1992 (*OJ* No. K 1 of 3 January 1994), Protocol No. 28.

extending copyright term to author's life plus 70 years.[10] U.S. copyright owners could then enjoy reciprocal copyright term extension in EU member countries. Applying leverage through free trade negotiations, the United States has pressed other countries to conform. Singapore and Australia complied in 2004.

Through extensive legal research, we compiled Table 1, which reviews legal changes, if any, with respect to the term of copyright protection in 29 jurisdictions between 1991 and 2004.

Owing to data limitations, we confined our empirical analysis to the period 1991-2002 and Organisation for Economic Co-operation and Development (OECD) member countries. Referring to Table 1, the following nineteen OECD countries extended copyright term during the period: Belgium, Czech Republic, Denmark, Finland, France, Greece, Hungary, Ireland, Italy, Netherlands, Poland, Portugal, Slovakia, Spain, Sweden, Switzerland, Turkey, the United Kingdom, and the United States. The following seven OECD countries did not extend copyright term during the period: Australia, Austria, Canada, Germany, Japan, Korea, and New Zealand.[11]

4. Model

We model the production of creative work as being subject to monopolistic competition. Each creator i invests $k_i Q_i$, where k_i is the investment per work and Q_i is the number of titles created. The creator then receives revenue $R_{it}(k_i, Q_i)$ in periods $t = 0, ..., T$, where T is the last year of copyright protection. For simplicity, we assume that, upon expiry of copyright, the creator receives zero revenue. The cost of production is $k_i Q_i$. Further, let the time-discount factor be δ_t, which possibly varies with time.

Suppose that the creator chooses k_i and Q_i to maximize the net present value,

$$\Pi_i = \sum_{t=1}^{T} \delta_t R_{it}(k_i, Q_i) - k_i Q_i . \tag{1}$$

The first-order conditions with respect to k_i and Q_i are, respectively,

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[10] Conveniently for the Disney Company, the CTEA went into effect on October 27, 1998, four years before the copyright on Mickey Mouse would have expired (Wasko 2001).

[11] In 1994, both Canada and New Zealand extended copyright duration but the extensions were minimal, so we ignored these.

$$\sum_{t=1}^{T} \delta_t \frac{\partial R_{it}}{\partial k_i} = Q_i \, , \tag{2}$$

$$\sum_{t=1}^{T} \delta_t \frac{\partial R_{it}}{\partial Q_i} = k_i \, . \tag{3}$$

With copyright term extension from T to $T+e$, the first-order conditions would become,

$$\sum_{t=1}^{T+e} \delta_t \frac{\partial R_{it}}{\partial k_i} = Q_i^* \, , \tag{4}$$

$$\sum_{t=1}^{T+e} \delta_t \frac{\partial R_{it}}{\partial Q_i} = k_i^* \, . \tag{5}$$

Comparing (2)-(3) with (4)-(5), the copyright term extension would lead to an increase in the profit-maximizing levels of both number of titles and investment per work. By (4)-(5), owing to the discount factor, each additional year of copyright protection increases the discounted revenue by a proportionately smaller amount, as emphasized by Akerlof et al. (2002).

In this study, we focus on the quantity produced, and associate "production" with the number of titles. Accordingly, by (2) and (4), our estimating equation is

$$\text{PRODUCTION} = f(\text{COPYRIGHT\_LAW}, X) \, , \tag{6}$$

where X is a vector of other variables that might possibly affect the producer's revenue over the term of copyright and COPYRIGHT_LAW is an indicator of whether the country had extended the term of copyright (= 0 if not, = 1 if yes).

Before reviewing the data and specification, it is worthwhile to consider a numerical example of the possible impact of the copyright term extension on movie production.

The term of copyright in the United States for movies is that for "works for hire", which was 75 years, until extended in 1998 to 95 years by the CTEA. Let the income from the movie in year 76 be A. During the extended term, let the real interest rate be i, the obsolescence rate be δ, and the growth rate of income be g. Then, the present value in the year of production of the cumulative income over the extended term would be

$$\Delta \Pi = \frac{1}{[1+i]^{75}} A \sum_{t=1}^{20} \frac{[1-\delta]^t [1+g]^t}{[1+i]^t} = \frac{1}{[1+i]^{75}} \frac{A[1-r^{20}]}{1-r} \, , \tag{7}$$

where the discount rate

$$r \equiv \frac{[1-\delta][1+g]}{1+i} .$$

We fit (7) with Rappaport's (1998) data on the actual royalties from movies produced in 1933-36. The copyrights on these movies would have expired in 2008-2011 but for the CTEA.

For the long-term real interest rate, we use 7%, which was the long-term real rate of return on U.S. equities over the period 1871–2001 (Campbell 2002).[12] [13] We set the obsolescence rate, $\delta = 0.018$ (Rappaport 1998), and to be conservative, we set the growth rate, $g = 0$.

As calculated in Appendix 1, the present value of the additional copyright term, $\Delta\Pi = \$4,924$ or $\$5,625$, according to the real long-term interest rate being 7% or 5%. The impact of this additional profit would depend on its relation to the profit absent the copyright term extension and, as emphasized by Liebowitz and Margolis (2005), the movie producers' elasticity of supply.[14]

We could find the relevant information only for Warner Brothers. Between 1933-36, Warner Brothers produced 166 movies which yielded an average profit of $\$154,831$ (Pokorny and Sedgwick (2004), Table 7.1).[15] Accordingly, the extension of copyright term would have increased expected profit by 4,924/154,831 = 3.2% or 5,625/154,831 = 3.6%, depending on whether the real long-term interest rate is assumed to be 7% or 5% (see Table 2).

While this increase might not seem large, it certainly is not negligible. Moreover, the example under-estimates the impact of copyright term extension for two reasons. First, such an estimate overlooks the future growth of income due to the growth of population

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[12] Akerlof et al. (2002) used a rate of 7%, which they considered to be "conservative, given the high degree of uncertainty about the revenues resulting from the production of a creative work". However, they overlooked that, even from the early years, studios diversified risk by producing movies as portfolios rather than individual investments (Pokorny and Sedgwick 2005).

[13] Over the similar period, 1870-2004, the long-term real interest rate on U.S. government securities was 3% (Girola 2002),

[14] By contrast, Akerlof et al. (2002) focused on the impact of the extension on the *entire present value* of a new work. They calculated that a 20-year extension from year 75 to year 95 would increase the present value of a new work by just 0.47% (footnote 8).

[15] Warner Brothers is a reasonable proxy as it produced a balance of "A" and "B" movies, by contrast with MGM which focused on high-end movies especially musicals and Columbia and Universal which tended to focus on lower-end "B" movies (Waterman 2005, page 37). Generally, "A" movies were more profitable than "B" movies (Pokorny and Sedgwick 2005).

and income, and expansion to new markets (Liebowitz 2006). Between 1947-2003, U.S. movie studios' domestic revenues increased from $365 million to $21.619 billion in nominal terms (Waterman 2005, pp. 290-291, Table C.1), or deflated by the Consumer Price Index from $546 million to $3.923 billion, which was an increase of 719%.

Second, the estimate ignores the value of the real option of creating sequels and derivatives and exploiting new technologies. The owner of a movie that becomes a hit can exploit its popularity through sequels and derivative products such as TV serials, video-tapes, and souvenirs. Rappaport's (1998) list of hits from the 1930s included the *Wizard of Oz,* produced by MGM and Loew's in 1939. The Internet Movie Database lists 32 other subsequent audio-visual works with the same or similar title as the *Wizard of Oz*. In 1947, U.S. studios' domestic revenues relied completely on theatrical exhibition, while by 2003, theatrical exhibition comprised just 23% of revenues, with home video (56%) and television (21%) making up the remainder.

We should note that our estimate is biased upward to the extent of income that studios would earn even if movies are not protected by copyright.

5. Data and Specification

Copyrightable works include books, illustrations, photographs, sound recordings, audio-visual works, and software. Among these, so far as we are aware, audio-visual works is the only category about which there is comprehensive international information over a reasonable period of time. These are contained in the Internet Movie Database ("IMDb").

The IMBb proclaims itself to be "Earth's biggest movie database" and is sponsored by Amazon.com. The bulk of its information is submitted by industry members and website visitors. Indeed, about 70% of the IMDb staff is dedicated to processing the information received and adding to the database. The database is segmented into "IMDb" and "IMDbPro". Searches in the IMDbPro may exclude video games and short films, and hence are better defined.

Using the IMDbPro, we extracted information about various characteristics of movies created in the twenty-six OECD member countries during the period 1991-2002. To gauge the reliability of the IMDbPro, we compared it with the Film Index International, published by the British Film Institute, which also publishes movie data. The correlation

between the movie data in the Film Index International and IMDbPro was 93%.

Referring to Table 3, for each country and year, we obtained information from the OECD and Euromonitor International's Global Market Information Database about other national characteristics that might possibly affect the demand for movies and hence movie production – population, GDP per capita, and real interest rates.

We specified the model as a least-squares regression with the dependent variable being the number of movies created in that country-year, and the independent variables being the copyright law indicator and other variables that might possibly influence movie production. Among these other variables, to minimize multi-collinearity, all national aggregates other than population were specified on a per capita basis. All specifications included country fixed effects.

An immediate concern is that all of the changes in copyright term were in the same direction. General changes in technology, such as digitization, and financial conditions, such as a secular fall in real interest rates, might have increased the incentive to produce movies at the same time as the extensions of copyright term. Hence, any increase in movie production might be due to improvements in technology and easier financial conditions rather than the extended copyright term.

We addressed this concern by including seven countries that did *not* extend copyright term during the entire period of study. They serve to distinguish the impact of copyright extension from any contemporaneous changes in technology or financial conditions that might have also affected the incentive to produce movies.

-- Figure 1: Average number of co-producing countries per movie –

Another concern is that there was a secular trend in the movie industry towards more international co-production, as illustrated by Figure 1, which shows the average number of co-producing countries per movie over the period 1991-2002. To account for this trend, we specified the dependent variable in two alternative ways – one was to adjust the number of movies by the number of countries of production, e.g., if a movie was produced in the U.S. and Germany, then it would contribute 0.5 to the number of movies created in the U.S. and Germany respectively for that year, while the other way was to disregard movies with co-production.[16]

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[16] To collect the data, we queried the IMDbPro by country and year, and then matched movies by

Figure 2 illustrates the average movie production per capita, by country and year, with production adjusted by the number of countries of production.

-- Figure 2: Movie production per capita –

6. Results

We first applied a very simple approach, regressing the number of movies produced on GDP per capita, population, country fixed effects, a time trend, and the copyright law indicator. Table 4, column (a), reports the results. The coefficients of GDP per capita and population were positive and significant.   The coefficient of the copyright law indicator was positive and significant. Based on the mean number of movies produced, 76.74, the increase in movie production associated with the copyright term extension was 10.4% ($\pm$4.89%).

We next estimated a specification including one more explanatory variable – the real long-term interest rate.   Unfortunately, data on real long-term interest rates were not available for half or more of the sample period for the Czech Republic, Greece, Hungary, Poland, Slovakia, and Turkey. This limited our sample to 251 including 23 countries. Table 4, column (b), reports the results. The coefficients of GDP per capita and population were positive and significant, but the coefficient of the real long-term interest rate was not significant. The coefficient of the copyright law indicator was positive and significant, albeit slightly lower than in specification (a).

One concern is that the extensions of copyright term occurred together with changes in laws or regulations that improved the overall investment climate across the entire economy. Specifically, the European Union harmonized the copyright term as part of its single-market initiative, and Central and East European countries extended their copyright term in anticipation of joining the European Union. Hence, any increase in movie production might be due to market expansion rather than the extended copyright term.

To control for these general economy-wide changes in the return to investment, we included an additional variable – per capita R&D expenditure. Any market expansion would have increased the incentive to invest in R&D as well as the incentive to produce movies, hence per capita R&D expenditure seems a reasonable moderating variable.

title. Accordingly, we could only adjust for co-production among the 26 countries in the sample.

Unfortunately, data on R&D expenditure was not available for Switzerland. This further reduced our sample to 239 including 22 countries.

Table 4, column (c), reports the results. The coefficients of GDP per capita and population were positive and significant, while the coefficients of the real long-term interest rate and per capita R&D expenditure were not significant. The coefficient of the copyright law indicator was slightly higher than in specification (a) and statistically significant.

The Motion Picture Association of America (MPAA) (2006) has vigorously denounced piracy: "Film theft has an enormous impact on filmmakers everywhere from New Zealand to South Africa jeopardizing the creative process and robbing local economies of the benefits derived from having a healthy film industry". If copyright law is important to creators of movies, then, movie production should be lower where piracy is higher.

Unfortunately, we were unable to procure the relevant data on movie piracy from the MPAA or elsewhere. However, we managed to obtain music CD piracy rates from the International Federation of the Phonographic Industry (IFPI). In the next specification, we included the music CD piracy rate.

Table 4, column (d), reports the results. The coefficients of GDP per capita and population were positive and significant, while the coefficients of the real long-term interest rate and per capita R&D expenditure were not significant. Consistent with the MPAA's pronouncement, the coefficient of piracy was negative and significant at the 87% level. As for our central issue, the coefficient of the copyright law indicator was slightly higher than in specifications (a) and (c), and statistically significant.

Besides directly affecting the production of movies, piracy should also have an indirect effect through the extensions of copyright term. Specifically, in countries where piracy is higher, the copyright term extension ought to have a smaller effect on movie production. Accordingly, in specification (e), we included another variable – the interaction of the copyright law indicator with the piracy rate.

Table 4, column (e), reports the results. Consistent with prediction, the coefficient of the interaction variable, -89.25 ($\pm$ 50.86), was negative and statistically significant. The mean piracy rate was 0.04507, with a standard deviation of 0.0635. Hence, in a country whose piracy rate is higher by one standard deviation, the impact of the copyright term

extension would be lower by 89.25 x 0.0635 = 5.67 movies. This result is quite compelling: apart from the incentive effect of copyright law, there seems to be no other good reason why extensions of copyright term should have smaller effects in countries with higher piracy.[17]

Among specifications (a)-(e), the copyright term extension was associated with an increase in movie production ranging between 8.51% (±4.60%) and 10.4% (±4.89%).

To check the robustness of the results in Table 4, we also did the following. First, to account for the influence of possible outliers, we re-estimated specification (d) another 22 times, omitting one country in turn.[18] Figure 3 shows the effects of the copyright term extension on movie production with one country omitted in turn. Specifically, Figure 3 shows the estimated increase in movie production associated with the copyright term extension, and the corresponding 95% and 90% confidence intervals. Evidently, the result was robust to the exclusion of any one country.

-- Figure 3: Impact of copyright term on movie production, excluding one country --

Second, we estimated specifications (a)-(e) with the dependent variable specified as all movies *excluding co-productions* rather than movies adjusted for co-productions. Table 5 reports the results. The coefficient of the copyright law indicator was positive and significant, and about the same magnitude as in Table 4. In specification (e), the coefficient of the interaction between the copyright law indicator and the piracy rate was negative and statistically significant at the 88% level.

Owing to the exclusion of co-productions, the mean movie production was lower than in Table 4. Hence, with similar magnitudes for the coefficient of the copyright law indicator, the estimated impact on movie production was larger. It ranged between 10.16% (±3.88%) and 12.65% (±5.23%).

By the results reported in Tables 3 and 4, we conclude that the copyright term extension was associated with a positive and statistically significant increase in movie production.

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[17] We also estimated a similar specification using IFPI statistics on music cassette piracy rather than music CD piracy, and obtained very similar results.
[18] Owing to missing data on the real interest rate for Hungary, Poland, and Turkey, and on R&D expenditure for Switzerland, the sample for specification (d) comprised only 22 countries.

7. Other Explanations

In light of the arguments put forth by Akerlof et al. (2002), our estimates of the increase in movie production associated with the copyright term extension might seem rather large.

What factors might we have overlooked?

7.1 Relocation of Production

EU Directive 93/98 had no effect in Austria and Germany as the term of copyright in both countries was already author's life plus 70 years. Referring to Figure 2, movie production in Austria dropped sharply around the time when EU Directive 93/98 took effect.

One explanation of this drop is that, prior to the Directive taking effect, studios had an incentive to produce movies in Austria – to take advantage of the longer copyright term. When, however, the Directive equalized the term of copyright throughout the European Union, studios might have relocated production to other countries.

To address this possible explanation, Figures 4(a) and 4(b) graph the proportion of each countries total movie production which comprises co-productions with Austria or Germany. There is no decreasing trend around 1995, except for one instance – Iceland's co-productions with Germany.

7.2 Government Movie Policy

One criticism is that we ignored government policy specific to the movie industry. In particular, as part of national and regional cultural policy, European countries systematically targeted movie production with government funding and tax incentives (Lange and Westcott 2004; Haase 2005).

The only source of data on government incentives for movie production that we could find was the European Audiovisual Observatory's KORBA online database. However, this provides only information about government funding, and the coverage for the years prior to 1995, the year in which EU Directive 93/98/CEE took effect, is fragmentary. The KORBA database covers only Austria, Germany, and Poland from 1991 onward, and Denmark and France from 1994 onward.

Nevertheless, we repeated the regressions of specifications (a)-(e) on this more limited sample, with government funding as an additional explanatory variable. The regressions of specifications (b)-(e) excluded Poland as we did not have any information on its real interest rate.

Table 6 reports the results. In all specifications, government funding was associated with a positive and significant increase in movie production. With regard to our central issue, in all specifications, the copyright term extension was also associated with a positive and significant increase in movie production.

7.3 Capital Effect

Another possible criticism of our results is that the copyright term extension might have affected the production of new movies through an indirect "capital effect". The supply of capital is crucial to movie production (Vogel 2001). Generally, the extensions of copyright term were retrospective, and so benefited owners of existing movies, especially those with copyright about to expire. The copyright term extension would have reduced their cost of capital, and might have induced them to increase investment generally, and specifically, in making movies.[19]

While this alternative explanation is plausible, it seems to be inconsistent with the data. Figure 5 graphs the trends in the number of studios and the average number of movies produced per studio in the entire sample of 26 countries. The figure shows a secular decline in average production per studio and an upward trend in the number of studios.

-- Figure 5: Number of studios and average movie production --

Evidently from Figure 5, any increase in movie production over time has mainly been the result of the entry of new studios, rather than increased production by existing studios. Yet, it is only the existing studios, and, in particular, those such as the Disney Company, with large libraries of old movies, that benefited from the retrospective copyright term extension. Figure 5 suggests that the increase in movie production cannot be explained by any capital effect.

The pattern in the U.S. movie industry was similar. Figure 6 depicts the average production of major vis-a-vis independent studios. The majors were Walt Disney, Universal Studios, 20th. Century Fox, Warner Brothers, Paramount Pictures, Sony Picture Studios, and New Line Cinema.[20] Clearly, the passage of the CTEA in 1998 did not induce

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[19] Akerlof et al. (2002) mentioned but dismissed this possibility. They argued that owners of existing movies would maximize profits by investing elsewhere.

[20] Metro-Goldwyn-Mayer was omitted because of its complicated history of merger and sale and repurchase of its film library.

the majors to increase movie production relative to other studios.[21]

-- Figure 6: U.S. studios: Average movie production --

Average production by the major studios, as depicted in Figure 6, seems rather low. Perhaps the major studios had outsourced production, while retaining control over distribution. To take account of any such structural changes in the movie industry, Figure 7 graph the trends in the average number of movies *distributed* by major and other studios for a longer period, starting in 1980 and ending in 2005. Among the majors, there was an increasing trend in the average number of movies distributed during the 1980s, but this stabilized in the low twenties by 1990, well before the CTEA was passed in 1998.

-- Figure 7: U.S. studios: Average movies distributed –

To further investigate the capital effect, we needed data on film libraries. The only relevant information that we could find were the sizes of film libraries of six majors – Disney, Fox, Paramount, Sony, Universal, and Warner – in the years 1994 and 1997 (Vogel 1994 and 1997). We then estimated specification (d) at the studio level, with an additional explanatory variable – the interaction between the indicator for the copyright term extension and the size of the studio's film library in 1994 or 1997. The capital effect implies that the coefficient of this interaction term would be positive.

Table 7 reports the results. With the dependent variable being movie production (columns (k) and (l)), the coefficient of the copyright law indicator was not significant. Regarding the capital effect, the coefficient of the interaction between the copyright law indicator and studio's film library size was not significant.

With the dependent variable being movie distribution (columns (m) and (n)), the coefficient of the copyright law indicator was positive but not significant. Regarding the capital effect, the coefficient of the interaction between the copyright law indicator and studio's film library size was positive but not significant.

Based on Figures 5-7 and Table 7, we reject the explanation that the copyright term extension increased movie production by reducing the studios' cost of capital.

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[21] While these figures suggest that the wealth effect did not induce studios to increase movie production, it is still possible that the wealth effect led studios to increase their average investment per movie.

17

8. Concluding Remarks

From the experience of twenty-six OECD countries, of which nineteen extended the term of copyright during the period 1991-2002, we found that the copyright term extension was associated with a significant increase in movie production.

The results were robust to alternative specifications, including controlling for the measurement of movie production and government funding of movie production. Further, the increase in movie production was not due to the retrospective copyright term extension increasing the supply of capital. The increase in movie production was due to the entry of new studios, rather than expansion of production by existing studios.

Using historical data, we calculated that the copyright term extension would have increased the profit of movies produced in 1933-36 by 3.2-3.6%. In this light, an increase in movie production of 8.5-10.4% does not seem unreasonable. Further, our empirical results are consistent with Rappaport's (1998) observation that, in 1988, 65% of movies created over forty-five years earlier, in the period 1933-1941, still had commercial value of about $400,000. It would also be consistent with the observation of Liebowitz and Margolis (2005) that, of a sample of 236 titles reviewed by *Book Review Digest* in the 1920s, 41% were still in print fifty-eight years later.

The most obvious direction for future work is to study the impact of changes in copyright term on the production of other creative work such as books and sound recordings. What is the elasticity of production in these other creative activities?

The next direction for future work is to study the production of creative work more deeply, to better understand the intermediate links between copyright law and creative output. How does copyright law affect investment in creative activity on two margins – the number of titles and the investment in each title? And, how do these investments translate into the quantity and quality of creative output such as movies, books, and recorded music?

The other direction for future work is to measure the impact of copyright law on the use of existing creative work, and specifically, on the benefit to end-users and also investment in creations that build upon earlier work.

With the results from these studies, it would then be possible to gauge the fundamental trade-off in copyright law between the incentive to create new work and the loss from restricting use of existing work. However, the key challenge in all of these

directions for future work is to acquire the relevant data.

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Table 1: Changes in copyright term, 1991-2004

Country	Effective year of copyright extension	Remarks
Australia	2004	Copyright Legislation Amendment Act, 2004.
Austria	None	Copyright term extended in 1972.
Belgium	1995	Law of 30 June 1994.
Canada	None	*De minimus* change in 1994: From author's life plus 50 years to author's life plus remainder of the calendar year of death plus 50 years.
Czech Republic	2000	Law No. 121/2000 Coll. of 7 April 2000.
Denmark	1995	L395 of 13 June 1995.
Finland	1995	Law No. 1654 of 22 December 1995.
France	1995	Law of 27 March 1997 s.L123-1.
Germany	None	Copyright term extended in 1965.
Greece	1995	Law of 24 December 1997.
Hong Kong (China)	None	Author's life plus 50 years (Copyright Ordinance, Chapter 528, Section 19).
Hungary	1994	Act VII of 1994.
India	1992	Extended from 50 years from first publication to 60 years from first publication (Copyright Amendment Bill, 1992).
Ireland	1995	S.I. 158 of 1995.
Italy	1995	D. Lgs. N. 654 of 26 May 1997.
Japan	2003	Copyright Law of Japan, Article 54, which was passed on June 12, 2003.
Luxembourg		
Netherlands	1995	Law 652 of 21 December 1995.
New Zealand	None	*De minimus* change in 1994: Extended from 50 years from making to 50 years from *later of* making or first publication (Copyright Act, 1994).
Poland	2000	Amendment to the Act on Copyright and Neighboring Rights, which was passed on 9 June 2000.

Portugal	1995	D.L. 334/97 of 27 November 1997.
Singapore	2004	Intellectual Property (Miscellaneous Amendments) Act, 15 June 2004.
Slovakia	1997	Copyright Act of 5 December 1997.
South Korea	None	Author's life plus 50 years.
Spain	1995	Law of 12 April 1996.
Sweden	1995	Act on Copyright in Literary and Artistic Works, amended 7 December 1995.
Switzerland	1993	Copyright Act (July 1993).
Turkey	1995	Copyright Act (Consolidation), 05/12/1951 (07/06/1995), No. 5846 (No. 4110).
United Kingdom	1995	The Duration of Copyright and Rights in Performances Regulations (S.I. 1995 No. 3297). Check: prior to 1995, term was 50 years from first performance?
United States	1998	Extended to 95 years from publication or 120 years from creation for audiovisual works made for hire (Sonny Bono Copyright Term Extension Act, 1998).

Table 2: Illustrative Calculation

Real interest rate	5%	7%
Present value of additional profit	$5,625	$4,924
Initial profit	$154,831	$154,831
Proportionate increase	3.6%	3.2%

Table 3: Descriptive statistics (26 countries)

Variable	Unit	Source	Mean	Min	Max	Std dev
Movies	–	IMDB	90.51	2	1077	170.7
Movies excl. co-production	–	IMDB	66.57	0	927	146.1
Movies adjusted for co-production	–	IMDB	76.74	1	995.5	157.0
GDP	Million USD at PPP	GMID	847418	39998	10357362	1620041
Population	'000	GMID	38691	3495	279807	54696
Real long-term interest rate[1]		IMF	0.04320	-0.03412	0.1506	0.02140
Copyright _Law	–	Table 1	0.5325	0	1	0.4998
R&D expenditure[2]	Million USD at PPP	OECD	20832	359.3	268368	46518
Piracy	%	IFPI	7.1%	0	48.53%	9.41%
Time	–	–	1996.57	1991	2002	3.43

Notes:
1. Real long-term interest rate was calculated as long-term interest rate less year-to-year change in the consumer price index. The real interest rates of Czech Republic, Greece, Hungary, Poland, Slovakia, and Turkey were missing for some years.
2. Real long-term interest rate calculated as long-term interest rate less change in year-to-year the consumer price index.

Table 4
Movie Production (Adjusted for Co-productions)

Independent variables	(a)	(b)	(c)	(d)	(e)
Constant	-1842*** (162.87)	-2142*** (175.77)	-2146*** (178.75)	-2145*** (179.29)	-2120*** (180.23)
GDP at PPP per capita	5.654*** (1.661)	1.875*** (0.643)	1.668*** (0.626)	1.585*** (0.608)	1.382** (0.634)
Population	0.01476*** (0.001363)	0.01770*** (0.001387)	0.01773*** (0.001395)	0.01772*** (0.001399)	0.01758*** (0.001403)
Real interest rate	n.a.	15.81 (38.07)	3.121 (51.52)	-10.73 (50.57)	-23.41 (50.88)
Copyright _Law	7.997** (3.756)	7.611* (4.115)	8.354* (4.368)	8.515* (4.385)	12.08** (5.241)
Piracy	n.a.	n.a.	n.a.	-39.73 (26.07)	27.86 (49.80)
Copyright _Law*Piracy	n.a.	n.a.	n.a.	n.a.	-89.25* (50.86)
R&D expenditure per capita	n.a.	n.a.	6.00 (13.85)	10.13 (14.01)	4.92 (12.95)
Time	-5.989*** (1.511)	-2.838*** (0.828)	-2.860*** (0.897)	-2.808*** (0.881)	-2.561*** (0.883)
Country fixed effects	Included	Included	Included	Included	Included
No. of observations	308	251	239	239	239
Adjusted-R^2	0.9861	0.9913	0.9912	0.9912	0.9913
F-statistic	750.0	1058.1	997.7	962.5	936.7
Mean movie production	76.74	89.48	93.09	93.09	93.09
Mean Piracy	n.a.	n.a.	n.a.	n.a.	0.04507
Increase in movie production associated with copyright term extension					
	10.42% ** (±4.89%)	8.51%* (±4.60%)	8.97%* (±4.69%)	9.15%* (±4.71%)	8.66%* (±4.63%)

**** significant at 99.9%; *** significant at 99%; ** significant at 95%; * significant at 90%.
Notes:
1. In column (b), some data are missing for Czech Republic, Greece, Hungary, Poland, Slovakia, and Turkey; in column (c), some data are missing for Australia, Czech Republic, Greece, Hungary, Luxembourg, New Zealand, Poland, Slovakia, Switzerland, and Turkey.
2. Japan was omitted from the country fixed effects.
3. Standard errors computed using White's (1980) heteroscedasticity adjustment.
4. Standard errors of the increase in movie production in the last row, columns (d) and (e), were calculated as $\sqrt{\mathrm{var}(b_1) + 2\mu\,\mathrm{cov}(b_1, b_2) + \mu^2\,\mathrm{var}(b_2)}$, where b_1 and b_2 are the coefficients of the copyright law indicator and the interaction of the copyright law indicator with the music CD piracy rate, and μ is the mean rate of music CD piracy.

Table 5
Movie Production (Excluding Co-productions)

Independent variables	(a)	(b)	(c)	(d)	(e)
Constant	-1689*** (153.15)	-1969*** (160.99)	-1981*** (164.26)	-1980*** (164.82)	-1958*** (165.64)
GDP at PPP per capita	5.089*** (1.489)	1.829*** (0.565)	1.549*** (0.516)	1.475*** (0.499)	1.295** (0.526)
Population	0.01358*** (0.001274)	0.01629*** (0.001269)	0.01636*** (0.001278)	0.01635*** (0.001282)	0.01623*** (0.001285)
Real interest rate	n.a.	1.458 (35.50)	-16.50 (46.95)	-28.69 (46.17)	-39.96 (46.68)
Copyright _Law	8.422** (3.485)	7.664** (3.844)	8.286** (4.070)	8.427** (4.087)	11.60** (4.922)
Piracy	n.a.	n.a.	n.a.	-34.96 (23.74)	25.09 (44.97)
Copyright _Law*Piracy	n.a.	n.a.	n.a.	n.a.	-79.31* (47.18)
R&D expenditure per capita	n.a.	n.a.	15.95 (12.98)	19.59 (13.25)	14.95 (12.28)
Time	-5.861*** (1.370)	-3.252*** (0.746)	-3.429*** (0.802)	-3.384*** (0.786)	-3.164*** (0.784)
Country fixed effects	Included	Included	Included	Included	Included
No. of observations	308	251	239	239	239
Adjusted-R^2	0.9865	0.9916	0.9915	0.9915	0.9916
F-statistic	772.3	1091.0	1032.9	996.0	968.5
Mean movie production	66.57	72.57	75.45	75.45	75.45
Mean Piracy	n.a.	n.a.	n.a.	n.a.	0.04956
Increase in movie production associated with copyright term extension					
	12.65%*** (±5.23%)	10.56%** (±5.30%)	10.98%*** (±4.65%)	11.17%*** (±4.65%)	10.16%*** (±3.88%)

**** significant at 99.9%; *** significant at 99%; ** significant at 95%; * significant at 90%.

Notes:
1. In column (b), some data are missing for Czech Republic, Greece, Hungary, Poland, Slovakia, and Turkey; in column (c), some data are missing for Australia, Czech Republic, Greece, Hungary, Luxembourg, New Zealand, Poland, Slovakia, Switzerland, and Turkey.
2. Japan was omitted from the country fixed effects.
3. Standard errors computed using White's (1980) heteroscedasticity adjustment.
4. Standard errors of the increase in movie production in the last row, columns (d) and (e), were calculated by same method as in Table 4.

Table 6
Movie Production and Government Funding

Independent variables	(a)	(b)	(c)	(d)	(e)
Constant	495.5 (548.1)	-612.3 (745.3)	-151.1 (787.1)	-157.9 (798.4)	-253.7 (808.4)
GDP at PPP per capita	-1.272 (2.272)	6.913 (5.163)	9.513 (6.905)	9.571 (6.964)	8.548 (7.365)
Population	-0.00505 (0.00655)	0.007028 (0.008394)	0.001215 (0.009372)	0.001277 (0.009511)	0.002564 (0.009635)
Real interest rate	n.a.	-229.4 (165.4)	-241.9 (160.6)	-242.6 (164.2)	-232.0 (169.5)
Copyright _Law	16.52*** (4.518)	10.89* (6.216)	10.28** (4.721)	10.24** (4.891)	0.9751 (6.920)
Piracy	n.a.	n.a.	n.a.	50.95 (709.9)	-388.7 (650.0)
Copyright _Law*Piracy	n.a.	n.a.	n.a.	n.a.	535.1 (372.5)
R&D expenditure per capita	n.a.	n.a.	-82.18 (95.97)	-82.41 (97.52)	-45.28 (112.7)
Government funding	0.000514*** (0.0000897)	0.000482*** (0.0000943)	0.000479*** (0.0000954)	0.000478*** (0.0000970)	0.000488*** (0.000102)
Time	-1.523 (1.929)	-10.43** (5.102)	-10.40* (5.120)	-10.44* (5.156)	-10.44* (5.156)
Country fixed effects	included	included	included	included	included
No. of observations	54	42	42	42	42
Adjusted-R^2	0.9724	0.9737	0.9657	0.9741	0.9744
F-statistic	172.1	131.5	116.5	102.5	92.08
Mean movie production	67.98	80.82	80.82	80.82	80.82
Mean Piracy	n.a.	n.a.	n.a.	n.a.	0.01792
Increase in movie production associated with copyright term extension					
	24.3%*** (±6.65%)	13.4%* (±7.69%)	12.7%** (±5.84%)	12.7%** (±6.05%)	13.1%** (±4.65%)

*** significant at 99%; ** significant at 95%; * significant at 90%.

Notes:
1. Countries included: Austria, Germany, and Poland (column (a) only), 1991-2002; Denmark and France, 1994-2002. Germany was omitted from the country fixed effects.
2. Standard errors computed using White's (1980) heteroscedasticity adjustment.
3. Standard error of the increase in movie production in column (e), last row, was calculated by same formula as in Table 4.

Table 7
Major U.S. studios

Independent variables	Dependent variable: Annual production		Dependent variable: Annual distribution	
	(k)	(l)	(m)	(n)
Constant	-639.7 (60.14)	-639.7 (602.0)	-480.2 (595.4)	-480.2 (603.9)
GDP at PPP per capita	-2.680 (3.309)	-2.680 (3.307)	-6.118 (4.371)	-6.118 (4.442)
Population	0.002709 (0.002370)	0.002709 (0.002377)	0.002311 (0.002265)	0.002311 (0.002299)
Real interest rate	73.76 (71.07)	73.76 (70.90)	98.10 (79.95)	98.10 (82.31)
Copyright _Law	1.448 (2.591)	1.305 (2.522)	2.838 (2.494)	3.692 (2.518)
Copyright _Law*Library_1994	-0.000541 (0.000705)	n.a.	0.000941 (0.000701)	n.a.
Copyright _Law*Library_1997	n.a.	-0.000341 (0.000444)	n.a.	0.000328 (0.000404)
Piracy	-32.90 (216.0)	-32.90 (217.4)	-373.1* (205.4)	-373.1* (213.3)
R&D expenditure per capita	29.18 (26.58)	29.18 (26.32)	47.67 (35.14)	47.67 (36.22)
Time	-4.514 (6.841)	-4.514 (6.808)	0.8959 (8.199)	0.8959 (8.311)
Studio fixed effects	included	included	included	included
No. of observations	72	72	72	72
Adjusted-R^2	0.6796	0.6792	0.9271	0.9258
F-statistic	12.58	12.56	70.49	69.12

*** significant at 99%; ** significant at 95%; * significant at 90%.

Notes:
1. Disney was omitted from the studio fixed effects.
2. Standard errors computed using White's (1980) heteroscedasticity adjustment.

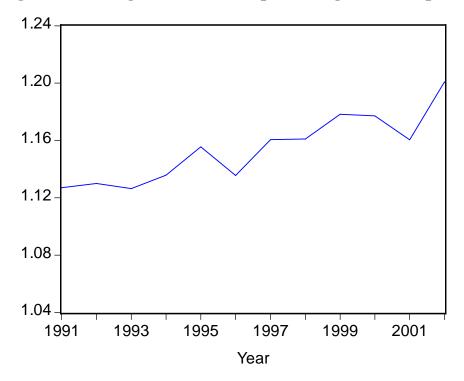## Figure 1: Average number of co-producing countries per movie

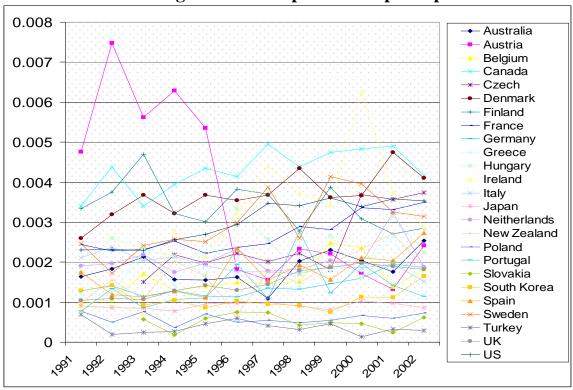
Figure 2: Movie production per capita

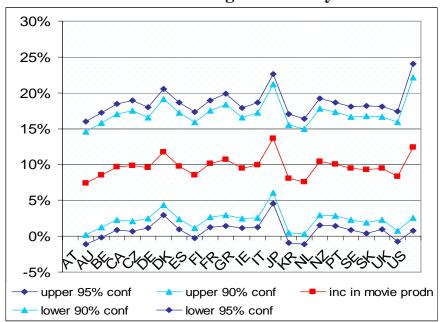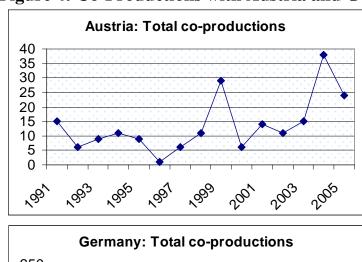**Figure 3: Impact of copyright term on movie production, excluding one country**

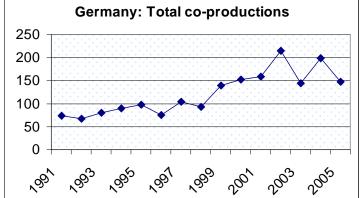**Figure 4: Co-Productions with Austria and Germany**

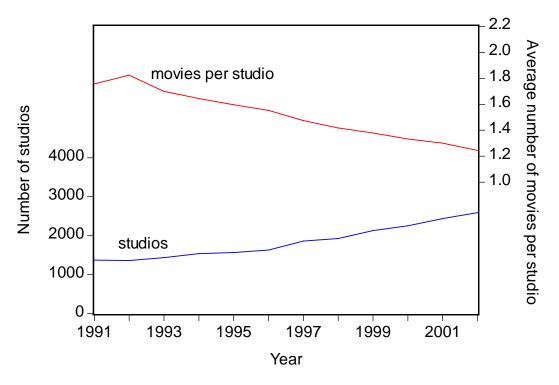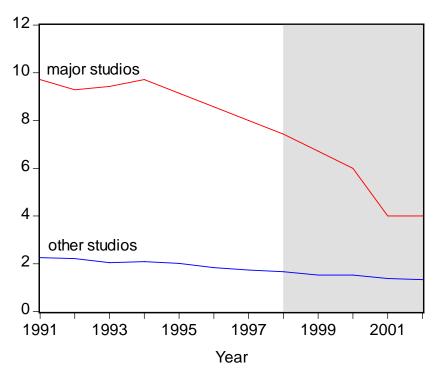**Figure 5: Number of studios and average movie production**
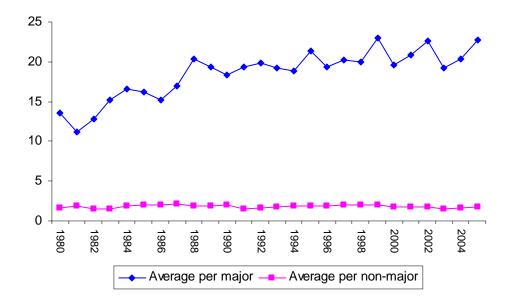

Figure 6: U.S. studios: Average movie production

Note: Without adjustment for co-production (between 1980-2005, only 26 of 21316 titles were associated with two companies)

Figure 7: U.S. studios: Average movie distribution

Appendix 1: Example

According to Rappaport (1998), pp. 14-15, 65% of movies produced in 1933-1936 with copyright renewed in 1961-64 were still commercially available in 1998. Each of these was projected to yield an average royalty of $48 million ÷ 1,934 = $24,820 annually in the last five years of 75-year copyright term (before it was extended by the CTEA). However, Rappaport (1998) did not report the percentage of movies produced in 1933-1936 whose copyright was renewed in 1961-64. Assuming that all were renewed, the ex-ante expected royalty would be 0.65 x $24,820 = $16,130 annually.

The preceding calculation applied to the run-of-the-mill movie. Rappaport (1998) estimated that 32 hits would each yield $1 million in annual royalties. Between 1926-1941, the number of movies produced with copyright renewed between 1954-1969 was 17,692 x 0.58 = 10,261 (42% of the titles pertained to shorts and commercials, and should be excluded). Accordingly, the probability of a movie being a hit was 32/10,261 = 0.31%.

Thus, the unconditional ex-ante expected royalty from a movie would be 0.9969 x $16,120 + 0.0031 x $1 million = $19.170 annually. Based on this projected annual royalty, the extension of copyright term by 20 years would have a present value in 1933 of $5,625.

Appendix 2: Data

1. Movie production (IMDbPro): Data for the Czech Republic and Slovakia were available only from 1993.

2. Real interest rates (IMF): Data for Hungary, Poland, and Turkey were missing for the entire period.

3. R&D expenditure (OECD): Data for Australia, Belgium, Denmark, Greece, Sweden and New Zealand were missing for every other year. For missing data, we used the expenditure for the previous year. Data for Switzerland were missing for the entire period.

4. Music CD piracy rates (IFPI): Data was available only from 1994-2000. For 1991-1993, we used the 1994 rates, while for 2001-2002, we used the 2000 rates.