On the Supply of Creative Work: Evidence from the Movies

Kai-Lung Hui and I.P.L. Png*

Copyright law must strike a delicate balance between the long-term need to encourage innovation against the short-term use of work already created (Plant 1934; Nordhaus 1969).[1] This balance depends on the extent to which stronger copyright protection actually stimulates creative activity, which in turn depends on two effects. One is the impact of copyright on the income of authors of books, movies, music, software, and other creative work. The other is the effect of the economic incentive in stimulating more creative activity.

Debate on these issues ranges from scholarly arguments that the extent of copyright is excessive (Lessig 2001; Boldrin and Levine 2002) to industry calls for expanding the length and scope of copyright. The debate, however, has not been much informed by empirical research, other than fragmentary evidence that the United States' 1891 extension of copyright law to foreigners had little impact on American and English authors (Plant 1934; Khan 2001), and that British composers and musicians receive minimal royalty income (Towse 2000).

In this paper, we investigate the impact of economic incentives on the international supply of big-screen movies. More particularly, we also study the impact of a 1998 increase in the term of copyright on U.S. movie production.

I. Setting

The demand and supply of motion pictures, on a national basis, can be characterized by the following structural equations:

$$Q_D = a_0 + a_1 P + a_2 VTR + a_3 TV + a_4 PDI + a_5 POP + \varepsilon \,, \qquad (1)$$

$$Q_S = b_0 + b_1 P + u \,, \qquad (2)$$

where Q_D and Q_S denote the quantities of movies demanded and supplied respectively, P represents the "price" of movies, *VTR* and *TV* represents the ownership of videotape recorders and televisions respectively, and *PDI* and *POP* denote personal disposable income and population respectively.

Regarding (1), the demand for movies is elastic (Blackstone and Bowman 1999), hence $a_1 < 0$. Since many households "consume" movies as pre-recorded videotapes, we expect $a_2 > 0$. The impact of TV ownership on the demand for movies is more complicated. People also "consume" movies through cable and free-to-the-air television channels. However, television programs compete with movie theaters for consumers' leisure time. Accordingly, a_3 might be positive or negative. As for the effects of income and population, we expect $a_4 > 0$ and $a_5 > 0$. Regarding the supply equation, we expect $b_1 \geq 0$.

In movie market equilibrium, $Q_D = Q_S$. Since movies are distributed in diverse ways, including cinema exhibition, cable and free-to-the-air television broadcast, and pre-recorded videotapes, the "price" of movies is rather nebulous. Hence, we use (2) to substitute for price in (1) to derive the equilibrium relation,

$$\left(1-\frac{a_1}{b_1}\right)Q=\left(a_0-\frac{a_1}{b_1}b_0\right)+a_2VTR+a_3TV+a_4PDI+a_5POP+\left(\varepsilon-\frac{a_1}{b_1}u\right) \qquad (3)$$

In the empirical work, we estimate (3) and investigate two questions. The first relates to the impact of economic incentives on the supply of creative work. We examine this indirectly by investigating how the ownership of videotape recorders and personal income affect movie production.[2] If the movie supply is completely inelastic, $b_1 = 0$, all the coefficients in (3), except the constant and random error, would be close to zero. By contrast, if we find empirically that the coefficients $a_2,\ldots,a_5$ are significantly different from zero, then we can infer that $b_1 > 0$, and that movie production does respond to economic incentives.

Our second question is the impact of a change in U.S. copyright law in 1998 on movie production. Pursuant to the 1976 Copyright Act, the term of copyright was the author's life plus 50 years. In 1998, Congress passed the Sonny Bono Copyright Term Extension Act, which extended the term to the author's life plus 70 years (Goldstein (1998), Section 4.7). We investigate whether this extension of 20 years led to an increase in U.S. movie production.

II. Data

We obtained information on big-screen movies from the Internet Movie Database (IMDB). The IMDB reports movies and television series by country of production and year. For each of 38 countries, including major movie markets such as Canada, Hong Kong, Japan, the United Kingdom, and the United States, we counted movies of over 60 minutes' length that were not made specifically for television or videotape.

We collected data on national ownership of videotape recorders and TV sets (color and black-and-white), personal disposable income, and population from the Global Market Information Database (GMID). Owing to data limitations, we confined our study to 1990-2000. We compiled a total of 418 observations. Table 1 reports descriptive statistics of the sample.

Empirically, the variables *TV* and *POP* were highly collinear (correlation coefficient = 0.9). We excluded *POP* from further analysis as it was also closely related to country-level fixed effects that we included to capture systematic unobserved national differences in movie demand.

Finally, the variable *VTR* was endogenous to the extent that the availability of movies influences the purchase of videotape recorders. To account for possible endogeneity, we used ownership of Hi-Fi stereos and CD players, collected from the GMID, as instruments for *VTR*.

III. Results

Table 2 presents regressions of movie production on *VTR*, *TV*, and *PDI* with country and year fixed effects, using both ordinary (OLS) and two-stage least squares (2SLS) methods. The OLS and 2SLS results were quite similar. (For brevity, we do not report the country and year fixed effects.)

<Insert Tables 1 and 2 here>

Referring to (3), since $a_1 < 0$ and $b_1 \geq 0$, the term $(1 - a_1/b_1)$ is positive, and hence, the estimated coefficients of *VTR*, *TV*, and *PDI* have the same signs as a_2, a_3, and a_4 respectively. Consistent with our *a priori* expectations, the coefficients of *VTR* and *PDI* were positive and significant. These results imply that the supply of movies was indeed elastic, and, in particular, sensitive to shifts in demand arising from changes in videotape player ownership and personal income.

In the year 2000, U.S. ownership of videotape players was 85.5 million units and 1,305 movies were produced. Based on our empirical estimates, a one percent increase in player ownership (0.855 million units) would have been associated with an increase in movie production by 11.9—14.7 units or 0.9—1.1 percent.

The effect of TV ownership was negative and marginally significant, which suggests that the substitution between watching television and going to movie theaters outweighed the distribution of movies through television and population growth (recall that the *TV* variable was collinear with population). Finally, movie production was subject to secular decline – all the time dummies were negative and significant.

We next addressed the impact of the Sonny Bono Act on U.S. movie production. We estimated (3) using the sub-sample of U.S. data with a linear year trend instead of year dummy variables to preserve degrees of freedom. We added an indicator variable

BONO, which was set to one for years 1999-2000 (after the Act was passed), and zero otherwise. Table 3 reports descriptive statistics of the U.S. sample.

Table 4 reports OLS results.[3] The coefficients of *VTR*, *TV*, *PDI* had the same signs as in the international regressions reported in Table 2. However, standard errors were relatively larger, which might be expected with only 11 observations. Nevertheless, the coefficients of *VTR* and *PDI* were close to significant at the 10% level.

<Insert Tables 3 and 4 here>

Comparing the regressions with and without the indicator *BONO*, the additional variable did not improve the model fit and served to inflate the standard errors of the various coefficients. The coefficient of *BONO* was positive, but by a one-tailed test, we rejected the hypothesis that the Sonny Bono Act led to an increase in U.S. movie production.

IV. Concluding Remarks

We found strong evidence that, at least in the case of movies, the supply of creative work did respond to economic incentives. As for the Sonny Bono Act, it appeared to have been a giveaway to owners of existing creative work, while having relatively little impact on new creative activity.

Future work could draw data on registrations of books and sound recordings from the U.S. Copyright Office to test the impact of other major changes in U.S. copyright law on the supply of creative work. Two events stand out in recent years. The 1976 Copyright Act drastically increased the term of U.S. copyright from 28 years, renewable for another 28 years, to the author's life plus 50 years. The other major event was the Supreme Court's 1991 *Feist* decision that telephone directories were not protected by copyright.[4]

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FOOTNOTES

* School of Computing, National University of Singapore, 3 Science Drive 2, Singapore 117543, Singapore; http://www.comp.nus.edu.sg/~ipng/.

1. The received wisdom must be modified for creative work that is a building block for further creative activity. In this case, an increase in copyright protection causes a long-term loss to the extent that it dissuades follow-on innovation or induces follow-on innovation to take a more costly path (Gallini and Scotchmer 2001).

2. In the early years, the movie studios probably did not anticipate the huge potential demand for pre-recorded videotapes. They sought, in the famous Betamax case, to enjoin consumer electronics manufacturers from producing and marketing videotape recorders (*Sony Corporation of America et. al. v. Universal City Studios, Inc., et. al.*, No. 81-1687, 464 U.S. 417). However, by 1986, U.S. revenues from pre-recorded videotapes exceeded those from theatrical exhibition (Vogel (2001), pp. 91-92).

3. For efficiency, we did not apply 2SLS as the sub-sample contained only 11 observations.

4. *Feist Publications, Inc. v. Rural Telephone Service Co., Inc.*, 499 U.S. 340 (1991).

TABLES

Table 1. Descriptive Statistics

Variable	Unit	Mean	Std. Dev.
Movies		71.823	154.247
VCR	Million	6.750	13.087
TV	Million	20.507	42.300
Disposable income	10^{12} US$	0.437	0.984

Table 2. International Movie Production[a]

Variable	OLS	2SLS
VCR	17.1810 ***	13.8995 ***
	(3.4992)	(3.0935)
TV	-0.2179 *	-0.2505 *
	(0.1243)	(0.1291)
PDI	73.1283 **	91.6323 ***
	(31.1901)	(34.9671)
N	418	418
Adjusted-R^2	0.9708	0.9704

[a] Standard errors calculated using White's heteroscedasticity-consistent covariance matrices in parentheses. All significance levels calculated using two-tailed tests.

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

Table 3. Descriptive Statistics – U.S. Sample

Variable	Unit	Mean	Std. Dev.
Movies		708.458	227.588
VCR	Million	59.048	19.767
TV	Million	88.953	9.522
Disposable income	10^{12} US$	5.505	0.876

Table 4. U.S. Movie Production[a]

Variable	Without *BONO*	With *BONO*
Constant	-4094.516	-4518.695
	(6918.980)	(7549.750)
VCR	148.081	157.130
	(77.713)	(87.114)
TV	-118.509	-111.045
	(117.568)	(128.385)
PDI	1544.683 **	1339.515
	(423.959)	(701.891)
Year	-522.220 **	-500.966 **
	(153.759)	(174.900)
BONO		68.599
		(177.929)
N	11	11
Adjusted-R^2	0.8558	0.8320

[a] Standard errors in parentheses. All significance levels, except for *BONO*, were calculated using two-tailed tests.

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