Forever Minus a Day? Theory and Empirics of Optimal Copyright Term

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Forever Minus a Day?

"Actually, Sonny wanted the term of copyright protection to last forever. I am informed by staff that such a change would violate the Constitution. ... As you know, there is also Jack Valenti's proposal for the term to last forever less one day. Perhaps the Committee may look at that next Congress."

– *Mary Bono during the debate in Congress on the CTEA*

Unprecedented Level of Change and Debate

- Term Extension in Many Countries in Last 15 Years
  - 1995: EU (Term Directive)
  - 1998: US (CTEA)
  - 2000s: Australia, Singapore etc
  - Today: Extension for recordings under consideration in EU
- Part of a trend stretching back to the 19th Century
  - e.g. 1841/1842: it was Walter Scott's children ...
  - Originally (Statute of Anne) term was 14+14
- Controversial and much debated ...

Basic Question

How Long Should Copyright Be?

(To Maximize Societal Welfare)

The ‘Forever Minus a Day’ of Jack Valenti – The original 14+14 years of the UK and US – Less? More? ...

Our Aim: To Answer This

- Derive a ‘proper’ estimate
  - First such with proper theoretical and empirical foundations
  - Existing work: Landes and Posner, Amicus Curiae, Liebowitz, Boldrin + Levine
    - Tends to be lacking in one (or both) respects
- Using new theory + new and existing data
  - NB: not a hard theoretical problem
  - Challenge is to bring data to bear

In The Process Will

- Develop proper dynamic framework
- Introduce ‘cultural decay’
- Connect revenue and welfare
- Make some (big) assumptions! 2 to mention up front:
    - No consideration of reuse issues
    - Ex-post investment ignore

The Problem

'Classic' Framework

- Copyright term/length: S
- Number of Works: N
  - Function of copyright level: $N = N(S)$
  - Increasing copyright increases works: $N' = N_S > 0$
  - (At least up to some level)
- Total welfare W, a function of N, S: $W = W(S, N)$
  - Longer term (N constant) reduces welfare: $W_S < 0$
  - More works increases welfare: $W_N > 0 \Rightarrow W_N N_S > 0$

'Classic' Trade-Off

- How does welfare change as term increases a little bit
  - $W'(S) = W_S + W_N N_S$ = d/w loss (-) + new production (+)
  - (-) Lower welfare from existing works: W_S
  - (+) Extra welfare from new works: $W_N N_S$
- The classic copyright trade-off
- Optimal term S where $W'(S) = 0$

So What's the Problem?

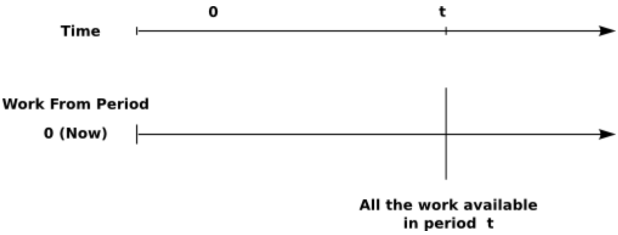
- To determine optimal term 'just' need to estimate:
  - W_N: welfare from new works
  - N_S: number of new works
  - W_S: increased d/w loss on existing works
- NO WAY we are going to do this directly
  - W_S: requires detailed demand data on *all* works
  - W_N: requires detailed demand data on marginal works
  - N_S: supply function (as a function of term)

The Challenge

- Marginal welfare $W'(S)$ in form we can **feasibly** estimate
- Estimate this with robustness checks

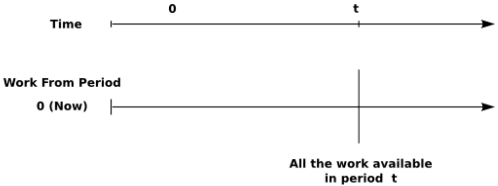
The Model

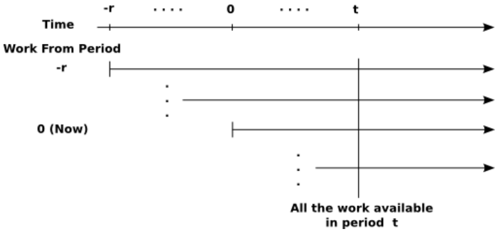
The Static Model



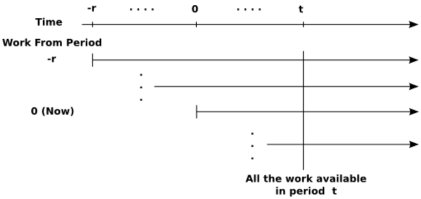
- Traditional approach is implicitly ‘static’
- Produce once (and consume actually or effectively once)
- But what about production in the future and the past?

A Dynamic Model





Dynamic Model: Details

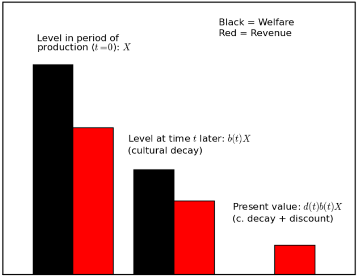


- Works are durable
- At time t have works from t, $t-1$, ...
- Like a macro model with capital of different 'vintages'
- Full model will be pretty complex
- Plus term will vary as one converges to steady-state
- Solution: evaluate changes in term on steady-state level
- $\Rightarrow$ we are ignoring transition effects
- + Assume steady-state involves constant production (no weird dynamics)

Dynamic Welfare

- Welfare (today) now at time t a function of:
  - Term S
  - Production in all prev. periods $n_{t-i}, \forall i$
  - $W = W(S, \{n_{t-i}\}_{i=0}^{\infty})$
- Production constant in steady-state $\Rightarrow n_k = n$
- $W = W(S, n)$
- But how is work from yesterday valued today?
- Introduce ‘Rate of cultural decay/depreciation’

Cultural Decay



- 'Cultural decay/depreciation' factor: $b(t)$
- Value of work today from vintage t is $b(t)$ of original level
- Affects revenue in same way
- Reasonable as revenue involves average expectations

Welfare looks backwards: c. decay only

Revenue looks forwards: c. decay and discounting

Final Form

$$W(S,n) = \underbrace{\sum_{i=0}^{\infty} b(i)Y(n)}_{\text{pot. wel. from all extant work}} - \underbrace{\sum_{i=0}^{S} b(i)Z(n)}_{\text{d/w loss on works in ©}} = Y(n)B(\infty) - Z(n)B(S)$$

- $Y(n), Z(n)$: 'potential' per period welfare and per period d/w loss on n works produced per period
- Linearly separable using cultural decay across periods
- Use aggregate functions as interaction among works
- Welfare under ©on a work = potential welfare - d/w loss
- Extrapolate this to aggregate level

Theoretical Results

Some Notation

- $d(i) =$ discount factor
- Capital/lower-case for total/marginal: $Y(n), y(n)$
- Capitals for sums of discounted values (1 unit for T periods):
  - Cultural decay: $B(T) = \sum_{i=0}^{T} b(i)$
  - Discount factor: $D(T) = \sum_{i=0}^{T} d(i)$
  - Both C. Decay + Discount: $DB(T) = \sum_{i=0}^{T} d(i)b(i)$
- PV of (prospective) revenue on jth work:
  - $R_j(T) = \sum_{i=0}^{T} d(i)r_j(t) = \sum_{0}^{T} d(i)b(i)r_j(0) = r_j(0)DB(T)$

First Order Condition

$$W(S,n) = Y(n)B(\infty) - Z(n)B(S) \Rightarrow$$

$$\begin{aligned}\frac{dW}{dS} &= \quad n'\left(y(n)B(\infty) - Z'(n)B(S)\right) \qquad -b(S)Z(n) \\ &= \quad \text{Gain in welfare from new works} \qquad -\text{Extra d/w loss on existing works}\end{aligned}$$

Need to work on n': the increase in production (per period)

$$\begin{aligned}\frac{dn}{dS} &= n \cdot s(n) \cdot \frac{d(S)b(S)}{DB(S)} \\ &= \text{Total existing works x Elasticity supply wrt revenue x \%tage increase in revenue}\end{aligned}$$

Copyright Term: Theory

$$
\begin{aligned}
W'(S) &= C\left(ns(n)\frac{d(S)}{DB(S)}\left(y(n)B(\infty) - B(S)z(n)\right) - Z(n)\right) \\
&= C'\left(\frac{d(S)}{DB(S)}\left(B(\infty) - B(S)\frac{z(n)}{y(n)}\right) - \frac{Z(n)/n}{s(n)y(n)}\right) \\
&= C' \cdot \Delta
\end{aligned}
$$

- C' a +ve constant so solving $W' = 0$ equivalent to solving $\Delta = 0$
- NB: cultural decay has largely 'disappeared' – it's common to both +/-
- $\frac{z(n)}{y(n)} = \alpha(n)$: d/w loss to total potential welfare on marginal work
- $\frac{Z(n)/n}{s(n)y(n)} = \theta(n)$: avg d/w loss to marginal welfare

Empirics

Estimating Parameters I

- Need to estimate: $d(i), b(i), \alpha(n), \theta(n)$
- Discount factor $d(i)$
  - Exponential form. Discount rate for agents (not society)
  - Discount rate: 4-9% with default of 6%
- Cultural decay: 2-9% with default of 5%
  - Source: data from UK recording industry cited by Gowers
  - Source: Nielsen sales data for books in UK
  - More discussion in paper

α

- $\alpha(n), \theta(n)$ the hardest as demand/supply data is scarce
  - But, ratios are easier ...
- $\alpha(n) = \frac{z(n)}{y(n)}$ = Ratio of d/w loss to welfare *on marginal work*
  - Assume this is constant = α
  - Literature limite as hard to get full demand curve
  - Take a 'conservative' range: $\alpha \in [0.05, 0.2]$ (use 0.125)
  - Linear demand: $\alpha = 0.25$, bigger tail (larger elasticity)

  $\Rightarrow\uparrow$ *alpha*

θ

- $\theta(n) = \frac{Z(n)/n}{s(n)y(n)}$ = avg d/w loss to marginal welfare
  - NB: Diminishing returns $\Rightarrow$ avg welfare > marginal welfare
- Key: assume welfare distbn over works follows sales distbn
- Literature suggest sales distbn follows a power law
  - Sale of jth work $\propto j^{\gamma}$)
  - Literature: $\gamma \in [0.048, 0.166]$ (best est. 0.129)
  - Power-law may be 'too generous' (tails too fat)
- $\Rightarrow$ avg. work to marginal work value = $1/\gamma$ (scale-free)
- $\Rightarrow \theta(n) = \frac{\alpha}{s(n)\gamma}$

θ and Elasticity of Supply

- Last item is $s(n)$: elasticity of supply wrt revenue
- Will assume $s(n)$ is constant
  - If rev. follows sales can apply similar scale-free arguments to argue for constancy and value around 1
  - Almost no relevant empirical data (I know of)
  - These are cultural works:
    - How revenue sensitive is supply?
    - Backwards bending supply curves (cf. Scherer on music)
  - Overall argue $s \in [0.5, 1.5]$ is reasonable

Results

Midpoint parameter estimates $\Rightarrow$ Optimal Term $= 15$ years

Robustness I

Cultural Decay Rate (%)	Discount Rate (%)	α	Optimal Term
2	4	0.05	51.8
3.5	5	0.07	30.7
5	6	0.1	18.5
6.5	7	0.15	10.6
8	8	0.2	6.5

Table: Optimal Term Under Various Scenarios. α is the proportion of potential welfare that is deadweight loss. *s* (the elasticity of supply) is set to 1 and γ (sales curve exponent) to 0.129.

Robustness II

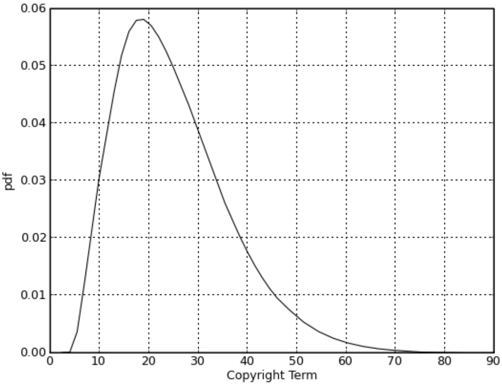


Figure: Probability distribution of optimal term given the parameter range set out above (with the exception that γ takes a single value of 0.129). 99th percentile at 38 years and 99.9th percentile at 47 years.

Robustness III

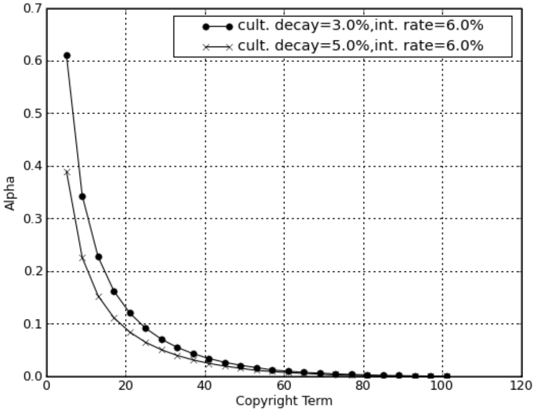


Figure: Break-even alpha (proportion of d/w loss on a work) as a

Concluding Remarks

Copyright Term

- Simple analytical expression that is empirically estimable
- Using plausible parameters optimal term was 15 years
- Any such point estimate is sensitive to changes in underlying parameters
- However: general conclusion that current terms are too long
  - Robust to varying parameters
  - Explicit Calculation of PDF gave 99.9th percentile under 50 years

Policy Implications

- Copyright term most important ‘variable’ for policy-makers
- Current terms are too long
- Should be extremely wary about extending term
  - Especially given ‘irreversibility’ of extension
- Clear need for more work to obtain/improve parameter estimates