

# Optimal Pricing and Quality of Academic Journals and the Ambiguous Welfare Effects of Forced Open Access: A Two-Sided Model

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- ① **Motivation**
- ② Model
- ③ Profits
- ④ Numerical simulation
- ⑤ Analysis of (the removal of) copyright
- ⑥ Conclusions

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- In this case all journals will be **forced to become open access** (Mueller-Langer and Watt, 2010).
- McCabe and Snyder (2005) argue that **open access journals are likely to compromise quality**.



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- What are the **overall welfare effects of a removal of copyright for academic works?**
- How is social welfare **distributed between journals and academics?**
- We use a **two-sided model of the journal market** to consider these questions.

- 1 Motivation
- 2 **Model**
- 3 Profits
- 4 Numerical simulation
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# Set-up and Notation

- A monopolistic, profit-maximising journal chooses **quality**,  $q$ , the **price charged to readers**,  $p_r$  (subscription fee), and the **price charged to authors**,  $p_a$  (sum of submission fee and publication fee).



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- The **number of authors is endogenously given** by  $n_a(q, p_a, n_r)$ .
- Both the number of readers and the number of authors are **determined by the quality chosen**.

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- The **number of readers is (partially) determined by the number of authors**, and vice versa.
- The fact that the **two functions**  $n_r(q, p_r, n_a)$  and  $n_a(q, p_a, n_r)$  are **interdependent** captures the **two-sided market feature of academic journals** as platforms for readers and authors.



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# Shape of Demand Functions and Production Functions

- In the same way,  $n_a(\bar{q}, p_a, \bar{n}_r)$  is again a **demand function**, and  $n_a(\bar{q}, \bar{p}_a, n_r)$  is a **production function**.

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- The production function **reflects the dependence of the number of authors of a journal on the number of its readers**.
- **Demand functions are negatively sloped, and the production functions are positively sloped and (weakly) concave:**

$$\begin{array}{lll} \frac{\partial n_r}{\partial p_r} < 0, & \frac{\partial n_r}{\partial n_a} > 0, & \frac{\partial^2 n_r}{\partial n_a^2} \leq 0, \\ \frac{\partial n_a}{\partial p_a} < 0, & \frac{\partial n_a}{\partial n_r} > 0, & \frac{\partial^2 n_a}{\partial n_r^2} \leq 0. \end{array}$$

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- The **profits earned by the journal** are just

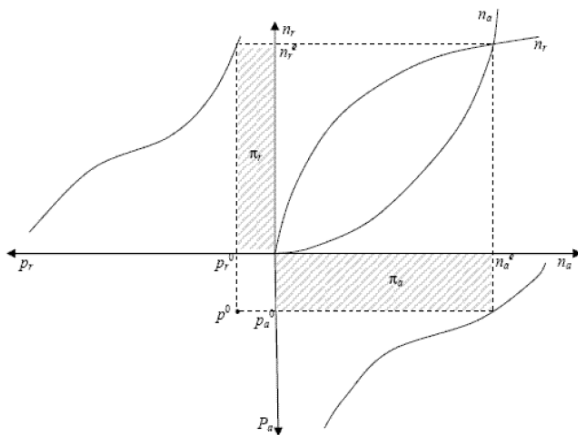
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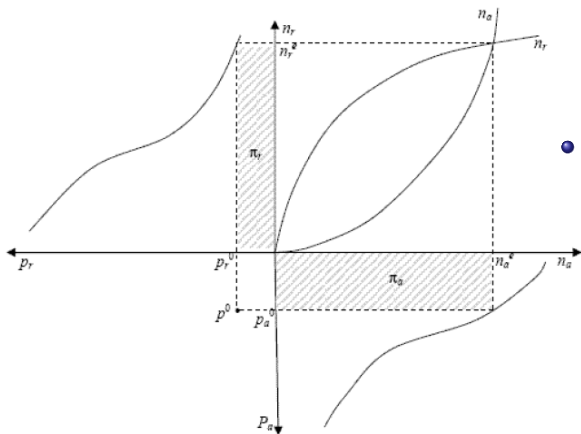
- The **journal profits** can be easily **represented graphically**.

Figure 1: Two-sided journal market in which profits are made from both sides



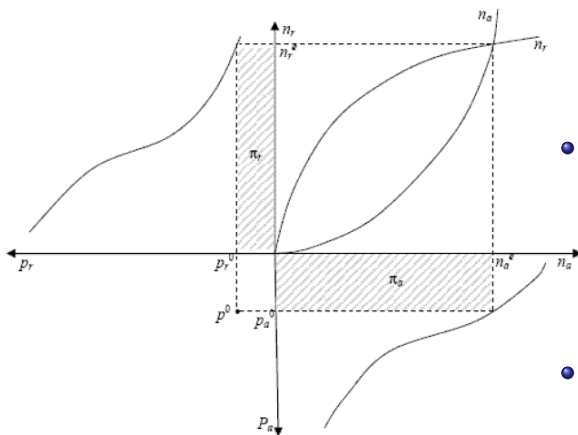
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- The sum of these **two rectangular areas** is the total profit.

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- Then, **given the optimal prices** for each quality level, we derive the **optimal quality** that the journal should choose.

- For any given  $(q, p_r, p_a)$ , we **simultaneously solve the two equations**  $n_r(q, p_r, n_a)$  and  $n_a(q, p_a, n_r)$  for the **two equilibrium levels of readers and authors**;

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- So the **profit of the journal** is

$$\pi(q, p_r, p_a) = p_r \times n_r^e(q, p_r, p_a) + p_a \times n_a^e(q, p_a, p_r)$$

- 1 Outline of the problems at hand
- 2 Model
- 3 Profits
- 4 **Numerical simulation**
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- **Model 1: Concave readers and authors production functions**

$$n_r = \sqrt{n_a} (\alpha q - p_r)$$

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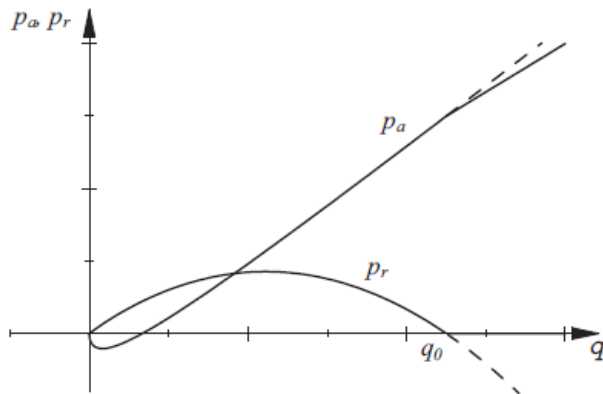
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- **In model 1, the optimal prices** are positive and given by:

$$p_r^* = p_a^* = \frac{\alpha q}{3}$$

# Figure 2: Optimal Prices in Model 2; High Quality Journals Choose Open Access (Reader Price of Zero)

With concave readers production function

For  $\alpha = 1$

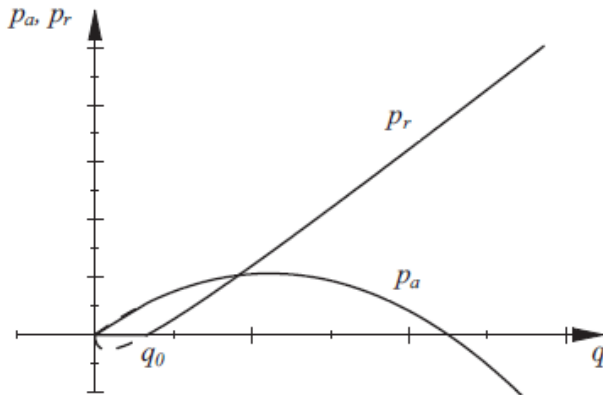




# Figure 3: Optimal Prices in Model 3; Low Quality Journals Choose Open Access (Reader Price of Zero)

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- The **way authors are treated** also varies over the models:
- They are **always charged in model 1**, they are **paid in model 2 for very low quality**, and they are paid in **model 3 for high quality**.

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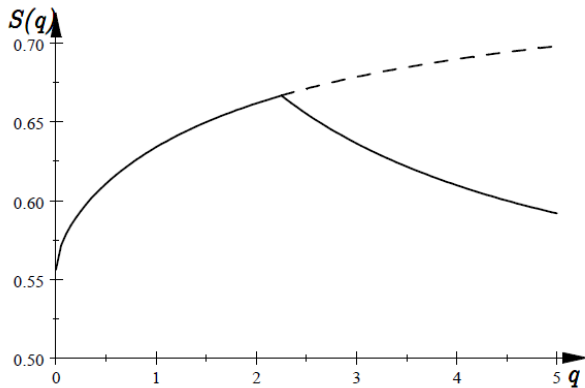
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- **In model 1, surplus is shared exactly equally** at all levels of quality, but in **models 2 and 3 we get more interesting results**:

Figure 4: Share of academic welfare in total welfare in model 2,  $S(q)$ , first increases and then decreases in quality

With concave readers production function

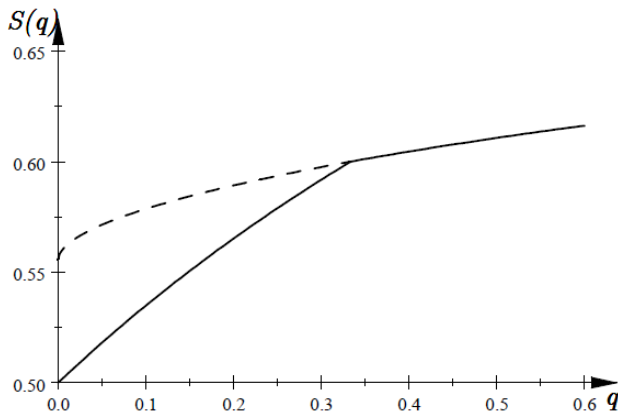
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# Figure 5: Share of academic welfare in total welfare in model 3, $S(q)$ , increases in quality

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For  $\alpha = 1$



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- The profit that the journal earns **is equal only to what it can earn from authors.**
- Ceteris paribus, **authors** now find it even **more appealing to publish** in the journal, since at a **reader price constrained to 0** there will **be maximum readership.**

# Removal of copyright increases author prices

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- All three new author prices are **unambiguously greater than the price under copyright**, and never negative.

# Effect of removal of copyright upon the numbers of readers and authors

**Removal of copyright** has the **following effects in the models:**

	<b>Number of readers</b>	<b>Number of authors</b>
<b>Model 1</b>	increases	increases (but by less)
<b>Model 2</b>	increases*	increases**
<b>Model 3</b>	increases for low $q$ , decreases for high $q$	decreases***

\*there is a very small zone of very low quality for which the number of readers declines, but the decline is insignificant

\*\*there is again a tiny decline for very low quality levels, but the decline is insignificant

\*\*\*there is an insignificant increase for very low levels of quality

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- In all three models, the removal of copyright **increases the surplus of readers.**
- The effect upon the **surplus of authors is ambiguous.**

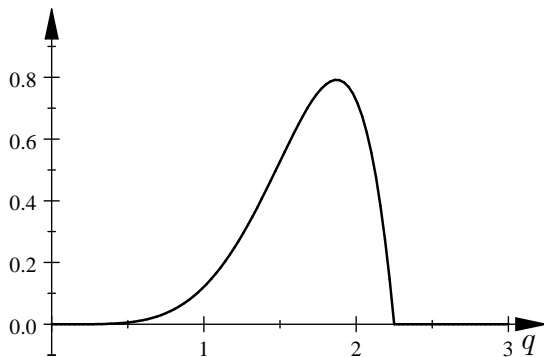
# Removal of copyright has positive welfare properties under model 1 conditions

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- As for the welfare properties of a removal of copyright, we find that it is **unambiguously welfare improving in model 1**.
- The **ambiguous welfare effects of removal of copyright in model 2 and model 3** can be represented **graphically**.

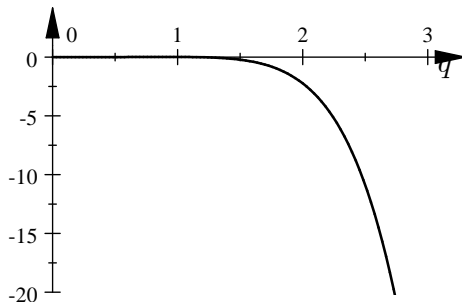
Figure 6: Absolute change in social welfare from removal of copyright in model 2 is positive on almost all quality levels



- Removal of copyright appears to be a **recommendable strategy** under model 2 conditions.



Figure 7: Absolute change in social welfare from removal of copyright in model 3 is negative and large for high quality



- Intuition: **High quality journal** suffers from **large profit losses**.
- Removal of copyright may be a **rather dangerous strategy** under model 3 conditions if it leads to the **closure of high-quality journals**.

- 1 Motivation
- 2 Model
- 3 Profits
- 4 Numerical simulation
- 5 Analysis of (the removal of) copyright
- 6 **Conclusions**

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- It would thus be interesting to **verify empirically** which, if any, of our three models is most likely to be real-world relevant.
- Depending on the results of this analysis, **our policy recommendation** is either to **remove copyright (models 1 and 2)**, or **not to remove copyright for academic works (model 3)**.



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# Consideration of Capacity Constraints I

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- Hence the **changes in the numbers of academics** under the removal of copyright **are important to our social welfare results** when we consider capacity constraints.
- **If removal of copyright increases** the numbers of readers and authors at each quality level (model 1 and 2 conditions), **then the capacity constraint must bind at a lower level of quality** as compared to the copyright-scenario.



# Consideration of Capacity Constraints II

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- The analysis of impact factors may bring us **closer to a reasonable measure of quality**.
- We may also analyse **the validity of the ISI impact factor** as an indicator of journal quality.

Thank you very much for your attention!

# Example for open access journal where copyright remains with authors



-  McCabe, M. and C. Snyder (2005), "Open Access and Academic Journal Quality", *American Economic Review*, 95(2); 453-8.
-  Mueller-Langer, F. and R. Watt (2010), "Copyright and Open Access for Scientific Works", *Review of Economic Research on Copyright Issues*, 7(1); 45-65.
-  Shavell, S. (2010), "Should Copyright of Academic Works be Abolished?", *Journal of Legal Analysis*, 2(1); 301-58.