On Publication, Refereeing and Working Hard

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Abstract

We present a model for academia with heterogeneous author types and endogenous effort to explain changes in the publication process in Economics. We analyze the implications of these developments on research output. Lowering the precision of refereeing signals has a negative impact on able authors but invites more submissions from less able authors. Increasing the number of journals stimulates less able authors to submit their papers. The editor can improve the journal's pool of submitted manuscripts by improving the precision of refereeing, but not by lowering quality standards. The submission strategy of an author is informative of his ability.

Keywords: academia, publishing, effort, refereeing, journals.

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1 Introduction

The publication process in Economics has changed significantly in last decades. New journals emerged, both general interest and field-specific. More authors submit their papers for publication, and acceptance rates went down significantly. Submitted manuscripits

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increased in length, the number of authors per paper rose, and more time is spent on revising before acceptance. Arguing about the costs and benefits of these changes for the profession and research quality in general requires understanding how authors' incentives change.

We propose a model of *academia* in which authors with heterogeneous abilities decide whether to submit their research for publication to different journals. The question of who submits papers constrains the editor, who picks the rule of admission based on perceived quality of articles. Authors exercise effort to improve the quality of their manuscripts, which benefits the acceptance chances.

Using our baseline model, we can represent most of the changes on the publication market mentioned above by varying observable institutional parameters, ranging from the relative importance of noise in the refereeing process, to increased competition among journals, to changes in quality standards. We show that our heterogeneous author types are affected differently by changes in institutional settings, affecting individual effort and overall research quality. We find that if referees supply noisier reports, it encourages less able authors to submit their papers to journals for consideration, making the competition harsher. Increased quality competition among journals increases effort and quality of papers submitted by more able authors, and decreases quality of manuscripts and effort exerted by less able authors. The introduction of outside options, such as open-access journals, decreases the quality of research output. When a general interest journal competes with a specialized field journal, only the intermediate ability authors find it optimal to submit their manuscripts to field journals first. Coauthorship might improve the average paper quality, but only intermediate ability authors collaborate.

The intuition behind many of our results extends immediately to other, more general, economic decision making environments where an informed principal needs to evaluate projects, followed by binary decisions over acceptance or rejection. Examples include matrimonial decisions, venture financing, standing for elections and job interviews. Since we—the authors as well as many of the readers of this paper—are particularly familiar with the academic publication market, for illustrative purposes we frame our model in this specific environment.

Following the literature review, we outline our baseline model, where authors choose between submitting their paper to a selective journal for a random chance of acceptance, or sending it off to an unread journal for certain publication. Then we extend our model to account for the possibility of writing multiple papers, co-authorship and sequential submission to multiple selective journals. Finally, we outline the informational content of publication decisions, and conclude with generalizing the context of our findings.

1.1 Literature Review

Since publications are among the most important factors regarding decisions on scientific development and career-related concerns, a thriving literature on the academic review process exists. We summarize the main results from this literature below.

Hamermesh (2013) analyzes publication data from the past sixty years. He finds significant changes in the methodology of published papers and a substantial increase in the number of authors per paper. Card and DellaVigna (2013) present a collection of stylized facts regarding trends in the academic publication market. The authors report that annual submissions to top journals in economics doubled since the 1970's but the total number of articles published in the same journals declined, thereby reducing acceptance rates from around 15% to 6%. The length of research articles tripled and the number of authors per paper increased significantly. The authors assert that their insights are consistent with an increase in quality competition among economists in the past decades. Ellison (2002) investigates trends in the academic review process and finds a substantial slowdown in turnaround times in the past 30 to 40 years (from 6 months to about 24 months) in top economic journals. He concludes that most of the slowdown is generated by shifts in social norms and increased quality competition. Ellison (2011) stresses the impact of "outside" options such as the internet or open access journals on the refereeing and publication process, suggesting that the role of journals in disseminating research has been reduced. His results indicate that the existence of outside options decreases the attractiveness of high end authors to go through the peer review process.

The following empirical results are generally agreeable.

Editors are active Laband (1990) analyzes the editorial decision making process in five top economics journals. While editors are found to be concerned with maintaining and improving the quality of papers published in their journals, he also finds that the screening process is by and large inefficient. Laband and Piette (1994) investigate the impact of editorial favoritism on the publication process. They find that favoritism may increase efficiency, but it also increases the variance in quality of published articles.[1]

Referees screen In Laband (1990), more frequently cited papers tend to have longer referee reports. Hamermesh (1994) presents various stylized facts about the refereeing process in economics such as matching of well known authors to better referees (positive sorting) and the general slowdown in the submission-acceptance times in top economic journals. He also finds that monetary incentives may speed up the review process. Azar (2005) focuses on first response times of journals and suggests that the observed slowdown in first-round-turnaround times could be socially beneficial, since effort costs of referees could have increased over time. Welch (2014) estimates the noise part in the referees' signals to be about twice as large as the common part.

Author identity matters Blank (1991) compares single- versus double-blind peer review systems via a randomized experiment using manuscripts submitted to the *American Economic Review*. Acceptance rates are lower for almost all researchers except researchers from top-5 departments (who arguably are harder to anonymize), and reviewers are less constructive under a presumably more noisy double-blind peer review system. The decline in acceptance rate is strongest for authors from mid-ranked economic departments. Bornmann (2011) provides a large-scope overview over academic refereeing processes, finding mixed evidence of a gender bias.

[1] Medoff (2003) argues that connected authors choose to publish their better papers where their friends are editors.

Many relevant theoretical contributions are related to incentives in refereeing. Engers and Gans (1998) show that, when referees care about the journal's quality, monetary incentives may speed up refereeing, but might slower the process of finding referees; this reduces efficiency and lowers journal quality. Chang and Lai (2001) on the other hand show that it might be optimal for editors to incentivize referees in equilibrium if the referees gain reputation from the refereeing activity itself. Their results imply that higher quality journals find it less difficult to recruit referees and may maintain their quality advantage.

Author incentives were studied, too. Leslie (2005) shows that submission fees and slow turnaround times at high quality journals can increase journal quality by discouraging "long-shot submissions", and Cotton (2013) introduces author heterogeneity with respect to sensitivity to these tools in order to warrant the equilibirum usage of both. Atal (2010) derives conditions under which competition among journals lowers quality cutoffs for publications. Similarly, Barbos (2014) shows that two-sided informational incompleteness from the perspectives of editors and authors may lead to a quantitative decrease in submitted papers.[2] Oster (1980) and Heintzelman and Nocetti (2009) study the optimal submission sequence: the former is concerned with trading off faster publication with larger prestige, whereas the latter extend the results to risk-aversion.

2 One Good Journal Model

The *academia* consists of the authors who submit their papers to the *editor* for publication.

There is a continuum of *authors* of measure 1. Authors are heterogeneous with respect to their abilities θ: a paper produced by an author of type θ has innate quality θ. θ is distributed with a cdf $G(\cdot)$ and a continuous strictly positive pdf of $g(\cdot)$ continuously on $(-\infty, +\infty)$. Authors can spend effort e to boost their paper quality up to $q = \theta + e$, paying

[2] Barbos (2014) investigates "project" submissions from a more general perspective, but the adaptation of the problem into the academic publishing process is straightforward. All intuition from our results in the publication framework retain in this more general "project" submission framework.

costs $c(e)$. The effort cost function is twice continuously differentiable, strictly convex and negligible at zero: $c''(e) > 0$, $c(0) = 0$ and $c'(0) = 0$.

The *editor* has discretion over papers to admit to the journal which has capacity T. The editor would like to fill the journal with the best available papers, but the editor can only observe the quality of papers supplied to her with noise. That is, upon sending the paper of quality q to referees for evaluation, the editor receives a signal of $\tilde{q} = q + \alpha\varepsilon$, where α is a positive parameter representing the comparative importance of noise in the referees' evaluations, and ε is the paper-specific noise, distributed with cdf $F(\cdot)$, and pdf $f(\cdot)$, positive on full support[3] $(-\infty, +\infty)$.

The editor's problem is then to choose which papers to publish after obtaining signals. She will use a cutoff rule: a paper is accepted for publication if $\tilde{q} > \hat{q}$.

The author's problem is twofold. Authors can attempt to submit their paper to the journal that has an audience (just *journal* hereafter). If the paper is accepted, the author scores 1 publication; normalize the utility of this outcome to 1. If the paper is getting rejected, the author can send it to an all-accepting journal that has no readers (*bad journal* hereafter), and collect $\delta\bar{u} < 1$ of reservation utility, where $\delta \in [0, 1)$ is the time discounting costs, and $\bar{u} \in [0, 1)$ is the payoff from having one more line in a CV. Alternatively, the author can send his paper to the bad journal immediately, and harvest $\bar{u}$ of utility. Thus, the author who attempts submission will choose effort based on maximizing

$$P(\theta + e + \alpha\varepsilon > \hat{q}) + (P(\theta + e + \alpha\varepsilon \leq \hat{q}))\,\delta\bar{u} - c(e) = 1 - \overbrace{[1 - \delta\bar{u}]}^{>0} F\left(\frac{\hat{q} - \theta - e}{\alpha}\right) - c(e).$$

The (pure strategy) equilibrium is a collection of the paper quality cutoff level $\hat{q}$; the author self-selection cutoff level $\hat{\theta}$; and the authors' effort choice level $e^*(\theta)$ such that

- the paper quality cutoff level $\hat{q}$ admits exactly T papers to the journal:

$$\int_{\hat{\theta}}^{+\infty} \left[1 - F\left(\frac{\hat{q} - \theta - e^*(\theta)}{\alpha}\right)\right] g(\theta)d\theta = T.$$

[3] Results extend if errors have bounded support.

- $e^*(\theta)$ solves the Effort Choice Problem of the author whose ability is $\theta \geq \hat{\theta}$:

$$e^*(\theta) = \arg\max_e \left\{ 1 - [1 - \delta \bar{u}] \, F\left(\frac{\hat{q} - \theta - e}{\alpha} \right) - c(e) \right\}.$$

- the author self-selection cutoff level $\hat{\theta}$ is such that only authors of $\theta > \hat{\theta}$ find it optimal to submit their papers:

$$1 - [1 - \delta \bar{u}] \, F\left(\frac{\hat{q} - \theta - e^*(\theta)}{\alpha} \right) - c(e^*(\theta)) \geq \bar{u} \text{ iff } \theta \geq \hat{\theta}.$$

By monotonicity of best responses there exists a unique equilibrium as defined above.

2.1 Effort Choice Problem

Consider an author with ability level θ who chooses effort level e. The first-order condition of this problem is

$$\frac{1 - \delta \bar{u}}{\alpha} f\left(\frac{\hat{q} - \theta - e}{\alpha} \right) = c'(e). \tag{1}$$

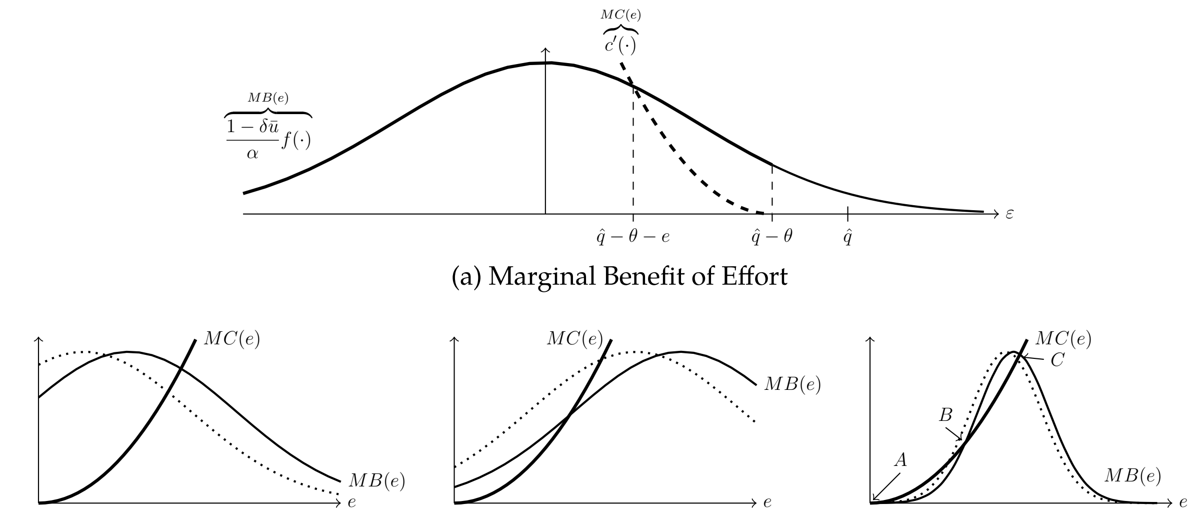
The second-order condition is

$$-\frac{1 - \delta \bar{u}}{\alpha^2} f'\left(\frac{\hat{q} - \theta - e}{\alpha} \right) - c''(e) < 0. \tag{2}$$

Even very large e cannot provide more than 1 unit of total utility, and for big enough e, $c(e) > 1$ by strict concavity. Moreover, since $f(\cdot) > 0$ and $c'(0) = 0$, zero effort is always suboptimal. Therefore, the effort choice is finite and upper hemicontinuous.

$f(\cdot)$ is single-peaked whenever $f(\cdot)$ is log-concave, which is a common assumption for "noise" in Economics. This is not a necessary assumption for the following results, but it is a useful property that allows a concise characterization of many results. Every density can be thought of as a single-peaked density with disturbances in the middle of the support.

Assumption 1. *$f(\cdot)$ is single-peaked, with peak at 0, and ε has a finite mean.*



(a) Marginal Benefit of Effort

(b) Large θ (c) Small θ (d) Multiple Intersections

NOTE: On Figures 1b–1d, the intersection of solid marginal benefit (MB) lines and dashed marginal cost (MC) lines represent the amount of effort chosen by authors of various levels of θ. Dotted lines represent the change of the marginal benefit due to an increase in θ.

Figure 1: Optimal Effort Choice

Result 1. *If $f(\cdot)$ is single-peaked, $e^*(\theta)$ is single-peaked.*[4]

$e^*()$ is single-valued for almost every θ, and so it is continuous almost everywhere. Many results discussed below hold even if $e^*(\theta)$ is multi-valued, as in Figure 1d, including the following one.

Proposition 1. *The quality of the submitted paper, $\theta + e^*(\theta)$, is increasing in type θ.*

2.2 Author's Best Response and Comparative Statics

In this subsection, we analyze the effects of changes in variables that are exogenous to an author's problem. The following result analyzes the effect of increased quality standards.

Result 2. *For almost every θ, an increase in $\hat{q}$ increases the effort level of more able submitters and decreases the effort level of less able submitters. The utility of all authors decreases.*

Since it gets harder to publish, those who have good chances of publication find it optimal to spend more effort to overcome the marginally higher hurdle, whereas those who have lower chances of publication give up.

[4] One can show that the maximum effort is exercised by an agent who writes a paper of a strictly lower quality than $\hat{q}$ because of the strict convexity of the cost function.

Result 3. *For almost every θ, an increase in $\bar{u}$ or δ decreases the effort level and increases the utility of those who submit. More authors submit their papers if δ increases, and fewer authors submit papers if $\bar{u}$ increases.*

If the bad journal starts being more attractive, it cannot decrease the utility of authors. A higher payoff associated with a publication in the bad journal limits the losses if the paper is not accepted, making spending effort less attractive. If we had the submission fee explicitly modeled, it would not increase the benefits of publication directly, and hence would not affect the effort, but it would lower the participation of authors.

Even without heterogeneity with respect to comparative acuteness of monetary versus time costs (á la Cotton, 2013), the difference in the effects of time and monetary costs on the endogenous effort and the participation rate can create variance in the application of the two across disciplines simply from the difference in the relative importance of effort and submission pool size for different disciplines.

2.3 Refereeing Quality

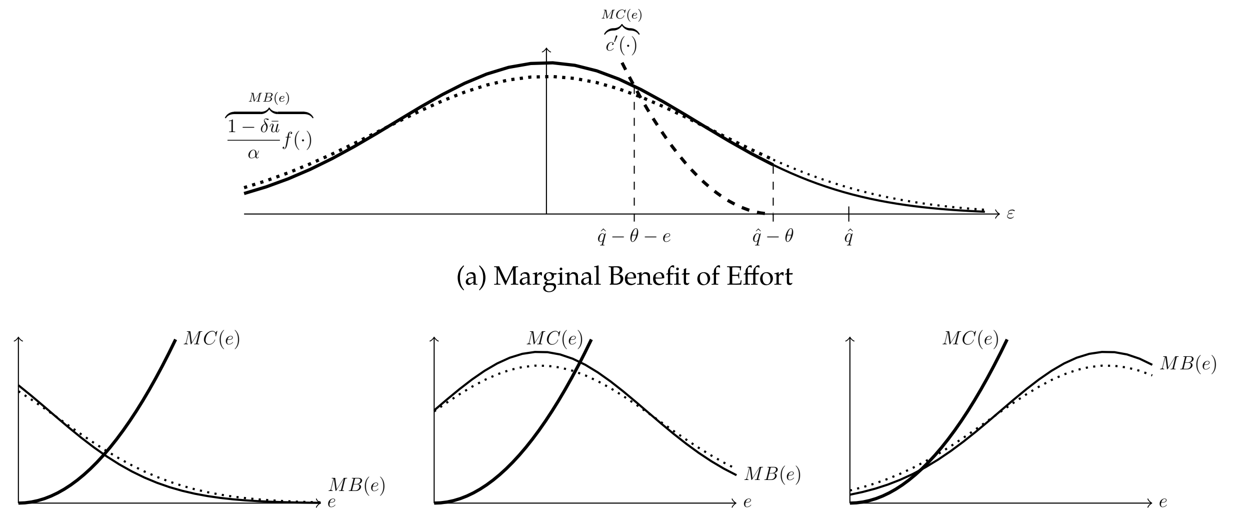
Let us denote θ_0 to be the value of θ such that the quality of the paper written by an author with $\theta = \theta_0$ is exactly $\hat{q}$:

$$\theta_0 : \hat{q} = \theta_0 + e^*(\theta_0).$$

This author publishes his paper if and only if his $\varepsilon > 0$.

Proposition 2. *For almost every θ, an increase in α lowers the effort level for authors in the neighborhood of θ_0, and increases the effort of those whose ability is high enough or low enough. The chance of publication increases for highly able authors and for authors of low ability, and decreases for authors with θ in the neighborhood of θ_0. The utility from submitting the paper decreases for able authors ($\theta > \theta_0$), and increases for less able authors.*

The economic reasoning behind the effect mentioned in the previous proposition is straightforward. When the noiseness of referees' evaluations increases, authors with very



(a) Marginal Benefit of Effort

(b) Large θ (c) Intermediate θ (d) Low θ

NOTE: On Figures 2b–2d, the intersection of the solid Marginal Benefit (MB) line and the dashed marginal cost (MC) line represents the effort choice for for the different values of θ. Dotted lines represent the change of the marginal benefit (MB) due to an increase in α.

Figure 2: Change in Effort due to Change in Refereeing Quality

low abilities face a higher chance of acceptance due to an increase in Type I errors: referees might provide very favorable reports to inferior papers, and the editor might publish their paper even if it was not very well written. These authors, simultaneously, do not exercise a lot of effort, and the marginal cost of effort for them is small. On the other hand, authors with very high θ face a higher chance of Type II error, and they increase their effort because their marginal cost of effort is small, because they don't apply much effort as well. Only authors of papers with quality approximately equal to the editor's imposed threshold decrease their efforts: their chances of Type I and Type II errors are relatively similar, though larger in absolute value. The marginal product of effort is smaller, because the same amount of extra effort compensates less noise, which leads to lower choice of effort.

Worse quality of refereeing does not have to be necessarily bad for the effort of authors, some authors might find it optimal to increase the efforts. The authors that increase their efforts, however, are away from the neighborhood of the mode of $f(\cdot)$, and therefore it is likely that most authors will lower their efforts. In any case, increasing α makes submission a better opportunity for less able authors, and a worse opportunity for authors whose work is above threshold.

This change in the behavior of individual authors will have consequences for the editor. If the threshold $\hat{q}$ was such that all submitters with $\theta > \hat{\theta}$ had also $\theta > \theta_0$, the increase in α will *lower* the quantity of submissions, and the journal would have unused capacity, which would call for lowering $\hat{q}$. This will lower the effort of those who submit. On the other hand, if the threshold $\hat{q}$ was less than $\theta_0 + e^*(\theta_0)$, the increase in α will make the threshold author's utility from submission strictly higher than $\bar{u}$, and thus less able authors would find it optimal to submit. Thus, more papers than T would be above the acceptable threshold. In both cases, the average quality of submissions can easily deteriorate.

This provides a potential explanation for why referees, many of which are prominent faculty with significant opportunity costs of foregone consulting, work on referee reports even though their pecuniary payoff from refereeing is meager. Worsening quality of referee reports hurts able authors in equilibrium, and referees in Economics journals are sophisticated enough to acknowledge this indirect effect. If this is not sufficient, demotivating less able authors from attempting submission will lower the amount of reviewing to do.

In the following extensions we will set α equal to 1 until we'll need it back.

3 Extensions

3.1 Two Good Journals, One Paper

Assume that, instead of one good journal, there are two good journals, indexed by 1 and 2, with a joint capacity of T.[5] Both editors are equally capable, and the refereeing technology in both journals is the same.

Same journals Assume the publication in either journal yields 1 unit of utility to the author. Assume the editors apply the same standard $\hat{\theta}$, the same they would use were they in the equilibrium with one journal, providing similar chances for publication for

[5]Retaining the same capacity allows to separate the effects of the increase of capacity from the effect of having more alternatives, which follows immediately from Result 2 via recognizing that higher capacity can only lower the admission standards.

the paper of quality q. Therefore, the only difference with the previous scenario is the possibility of resubmission.[6] Would the outcome discussed in Section 2 remain?

The authors submit papers to one of the journals for review; we will discuss simultaneous submissions later. If the editor of the chosen journal chooses to reject the paper, the paper is resubmitted[7] to another journal. We assume that editors are honest, and do not treat first- and second submissions differently (for instance, always rejecting all papers which were not submitted to their journals as a first choice): after all, the editors know the authors are indifferent between two journals.[8] Rejection however is an informative signal, and editors would like to know about it, but since it's an unfavorable signal, authors do not, in practice, advertise prior rejections in cover letters. The editor in our two-period model can learn that the paper was once rejected by looking at the calendar, but real-life editors do not have a perfect signal about the quantity of prior rejections, and can only infer it from the relative rank of their journal: similarly ranked journals are likely to face similar journal quality distributions in time.

The author who submits to journal 1, and then to journal 2, chooses the effort to maximize

$$1 - F(\hat{q} - \theta - e) + F(\hat{q} - \theta - e)\delta\left(1 - F(\hat{q} - \theta - e) + F(\hat{q} - \theta - e)\delta\bar{u}\right) - c(e).$$

The author then compares the expected value with the outside option $\bar{u}$, and submits the paper if the former is larger. The author's application decision changes insignificantly:

[6] This makes authors indifferent between two journals. However, in equilibrium, the average quality of published papers in two journals might be different if the amount of authors who aim at journal i is not proportional to the capacity of journal i.

[7] We omit the possibility of the interim revision, since by assumption, authors know the type of their papers, and can learn nothing from referee reports. The authors have no uncertainty about acceptance thresholds either. Inability to invest or disinvest efforts in between can be relaxed to obtain additional effects on effort allocation in time.

[8] Naturally, if the noise about the paper quality ε was correlated across journals, the rejection in another journal would be informative. We, however, want to minimize the change between the behavior of one editor and two editors, to concentrate on the effects that arize simply from two submission options instead of one. Having lower standard for those who submit as a first choice, compensated by a higher standard for the resubmitters, can encourage some of the authors, and prevent some resubmissions, lowering the referee load, but can admit papers of worse quality.

each author will either submit to one journal, and after rejection to another, or not submit at all. All publishing authors are strictly better off in the world with two journals, which implies that more authors will submit papers.

The author's effort choice problem changes, too. We will retain $e^*(\cdot)$ to denote the optimal effort choice. The new first-order condition is

$$(1-\delta+2\delta F(\hat{q}-\theta-e)[1-\delta\bar{u}])\,f\,(\hat{q}-\theta-e)=c'(e). \tag{1$'$}$$

Proposition 1 remains valid: the quality of a paper increases with ability. This monotonicity result is helpful in characterizing the change in effort.

Result 4. *Comparing the one-journal academia with the two-journal academia, in the latter, effort is higher for low-θ authors and lower for high-θ authors.*

From the point of view of the authors, the referees' opinion is now skewed to the right: even if the author gets an unfortunate review in the first round, his paper fails only if both reviews are unfortunate. Only authors with a small probability of publication might get motivated to exercise more effort. Therefore, the editors cannot, in general, retain the same cutoff as in the equilibrium with just one good journal. Since every author who found it optimal to submit his paper originally will still find it optimal to submit his paper when he has a chance to resubmit to another good journal, there will be more total submissions, and the admission cutoff is likely to go up.

The symmetric threshold equilibrium is not trembling-hand perfect: if the editor of journal 2 by chance picks a somewhat smaller admission threshold, authors would be delighted to submit to journal 2 first. The most important consequence of this outcome is that journal 2 would have a better distribution of papers under consideration: after all, journal 1 will only get papers that were rejected by the referees of journal 2. This will affect the readership, the refereeing load in both journals, and the reward from publication. Therefore, when there are two journals, they are likely to be different.

Different Journals Assume that a publication in journal 1 yields 1 unit of utility to an author, and a publication in journal 2 yields $\gamma < 1$ utility. The expected payoff of an author who submits to journal 1 first, and to journal 2 afterwards, is then

$$1 - F(\hat{q}_1 - \theta - e) + F(\hat{q}_1 - \theta - e)\delta\left(\gamma\left(1 - F(\hat{q}_2 - \theta - e)\right) + F(\hat{q}_2 - \theta - e)\delta\bar{u}\right) - c(e).$$

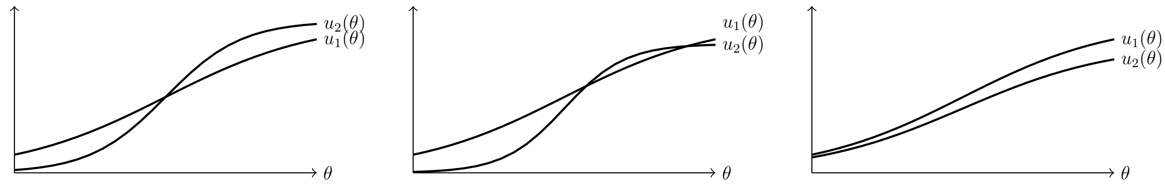
If editors apply the same standard $\hat{q} = \hat{q}_1 = \hat{q}_2$, providing same chances for publication for an author whose paper quality is q, if a paper is worth submitting to journal 2, it is worth submitting to journal 1. The reverse is not true.

Result 5. *The optimal submission strategy is to submit to journal 1, then to journal 2 if γ is significantly higher than $\bar{u}$.*

Lower θ needs higher γ for resubmission. Since we assume that ε is uncorrelated across journals, a new small but demanding journal with low payoff of acceptance can, in fact, obtain a better average quality of published papers than the equally demanding more prominent old journal. True, the new journal's submissions will consist only of the rejections of the old journal, but the support of submitters to the new journal will be narrower: authors of relatively low ability will abstain from resubmission of their rejected papers. Lowering the admission standards will not help to attract able authors.

Proposition 3. *When $f(\cdot)$ is log-concave, and journal 2 has lower admission standard, only authors with low ability will submit to journal 2 first.*

Field Journals To illustrate the decisionmaking in submissions and resubmissions to a field journal, we will modify the *different journals* framework to represent the journal's specialization. The referees in the journal are frequently authors in the same journal. At best, the editor in a general interest journal can provide an author with the same match of referees as in a specialized journal, but this is not in the interest of the general interest journal's editor: this editor wants the paper to be understandable and interesting for a general audience. Therefore, the referees' noiseness in the field journal $\alpha_2 = \alpha$ is less than



(a) $\alpha < 1, \gamma = 1$ (b) $\alpha < 1, \gamma < 1$ (c) $\alpha = 1, \gamma < 1$

Note: $u_i(\theta)$ is the utility of submitting first to journal i. Figure 3a represents the intuition of Proposition 2, Figure 3c represents the intuition of Result 5, Figure 3b shows what changes in Figure 3a in γ becomes slightly less than 1..

Figure 3: Field Journals as First Choice

in the first journal: $\alpha_1 = 1 > \alpha$. We will assume that the admission thresholds are the same[9].

Since the decrease in referees' noiseness improves the utility of submitters, able authors might be more interested in submitting their papers to field journals. However, since the payoff from publishing a paper in a field journal might be lower than from publishing the same paper in a general interest journal (because the readership is lower, or because the tenure committee thinks so), the most able authors, whose papers get published with a probability close to 1, would prefer a general interest journal. For less able authors, lower α is a deterrent for submission, so both effects, noiseness and payoff, discourage publication.

Proposition 4. *Among those who submit to both journals sequentially, if an author prefers to submit first to the field journal, this author's ability is neither extremely high nor extremely low. Such authors exist if the change in γ is not large compared to the change in α.*

Submitting to only one journal, or not submitting at all, might be an even better strategy, but, when α is in the neighborhood of 1, one can invoke Result 5 to rule out single-journal strategies.

Simultaneous Submission In Economics, most journals explicitly require authors to claim that the article has not been submitted to other journals. In other areas of science, such as Law, this is not so. Based on our model, switching to simultaneous submissions, as the first-order effect, will lower the time costs of the authors (more so if δ is further away from 1, or if the probability of acceptance in the first choice journal is low), and all authors would prefer to do simultaneous submissions, all else being equal. At the same time, the

[9]Bardhan (2003) was the source for our intuition.

editors will face competition for the best papers, enforcing lower turnaround times and competing for the readership.

However, lowering the effective time costs will also lower the authors' efforts, and will increase the referees' load—under sequential submission, all papers accepted in the first journal, are not considered by referees in the second journal. This might not translate into reading each paper twice, since some referees of the first journal might get the same paper to referee for the second journal. Unless editors coordinate perfectly, simultaneous submission will increase the referees' load. The overall payoff for the profession does not have to be higher as a result.[10]

3.2 Two Papers, One Journal

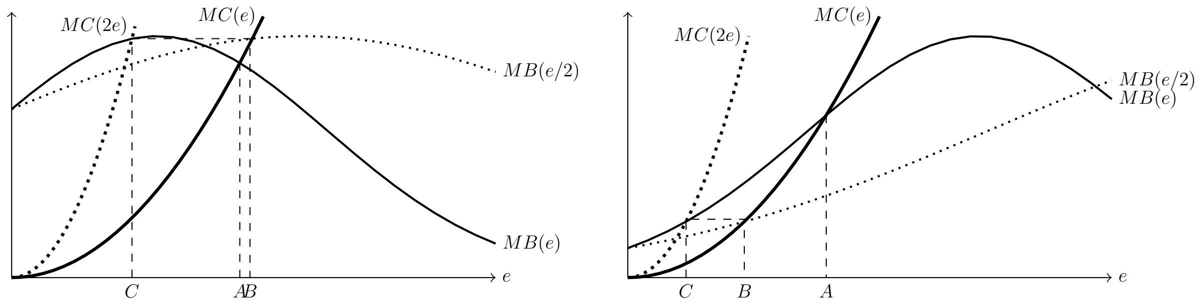
Many scholars, including the authors of this study, author more than one paper simultaneously. This allows them to apply their innate ability more than once per period, but requires spending more of total effort. This can be interpreted positively (the simultaneously incepted papers do not have to be about the same topic) or negatively (salami slicing). Let us model the choice to author two papers simultaneously by postulating the payoff from writing two papers, spending e of effort per paper, to be[11]

$$2\left(1-(1-\delta\bar{u})F(\hat{q}-\theta-e)\right)-c(2e),$$

where we put in an implicit assumption that submitting two papers of equal quality provides a higher expected utility than submitting one paper of high quality and another of quality θ. This is true when $1-F(-x)$ is a concave function of x, which should hold when x is high, since $f(-x)$ has to decrease eventually, so that $\int_{-\infty}^{+\infty} f(x)\,dx$ has to be equal to 1. That is, able authors, of high $\theta+e$, are likely to split their efforts equally. In the same

[10] There are other effects detrimental to the overall quality of the papers beyond the scope of our study (revision between submission rounds could be useful; the author might want to wait for the replies of all journals to pick the best, which increases the publication time; and so on).

[11] The implicit assumption here is that writing two papers and sending them to a bad journal yields $2\bar{u}$ of utility. In case of salami slicing, the utility of having two identical papers unpublished is at most $\bar{u}$.



(a) Large θ (b) Small θ

Note: Point A represents the effort choice of writing a single paper. Point B represents the total effort when writing two papers, point C represents the effort per paper.

Figure 4: Effort when Writing Two Papers

spirit, authors whose $\theta + e$ is small are facing a locally convex $1 - F(-x)$. If this convexity is not dominated by the convexity of $c(e)$, the less able authors might want to submit two papers: one with a quality as if they were submitting only one paper, and another of quality θ. If these authors submit one paper, they will submit two: the second paper comes with no effort attached. This is also strictly better than submitting only one paper if $\bar{u}$ is small enough.

The first-order condition that characterizes $e_2^*(\theta)$, the effort choice when submitting two papers, is

$$[1 - \delta\bar{u}]f(\hat{q} - \theta - e) = c'(2e). \tag{3}$$

It is immediate to establish the monotonicity of $\theta + e^*(\theta)$ and single-peakedness of $e^*(\theta)$ for single-peaked $f(\cdot)$.

Result 6. *For almost every θ, authors who submit two papers spend less effort per paper than they would if they submitted only one paper. The total effort spent on papers increases if θ is large enough, and decreases if θ is small enough.*

Effectively, if authors write multiple papers, from the point of view of the editor, it is as if there were more of authors, each exercising less effort because per-paper effort is costlier. Which authors prefer to submit a single paper, and which authors prefer to submit multiple papers?

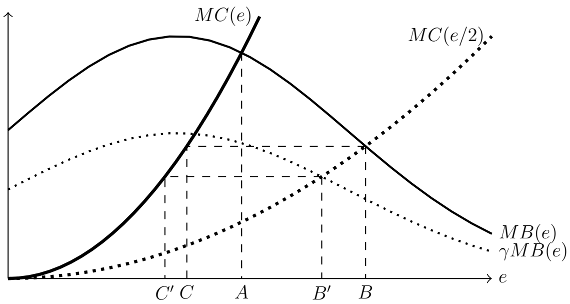
The able authors, whose θ permits them to hope for high chance of acceptance, will submit two papers, harvesting more than 1 in total expected payoff. The less able authors might find it optimal to submit only one paper, spend all effort on it, and write the second one for the bad journal. The total submissions will increase, there will be more papers, so the right tail of the distribution paper quality might improve. The editor will have to either increase the acceptance standard or to increase the journal's capacity. The first method will discourage submissions from the less able authors, but will, in general, hurt the utility of authors, especially of those who author a single paper. The second method of handling paper proliferation will increase the referee load.

3.3 Coauthorship

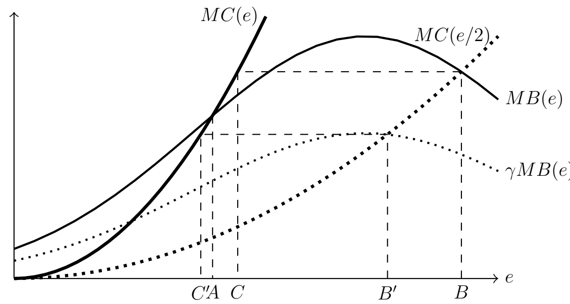
Many scholars, including the authors of this study, coauthor papers. They benefit from combining their different backgrounds, sharing their erudition and specializing in tasks. The single-dimensional ability model that we have can be extended to the decision of collaboration: we will assume that two coauthors sacrifice their independent research pursuits and morph into a single fictitious author. Let the productivity of a collaboration of two authors with abilities θ_1 and θ_2 be $\Theta(\theta_1, \theta_2)$, increasing in θ_i. Then each author will be interested in pairing with a better coauthor. If the matching process is perfect[12], the coauthors will be of equal ability, and their ability will be $\Theta(\theta, \theta)$. We will shut down the channel of the relative efficiency improvement, and assume that $\Theta(\theta, \theta) = \theta$; if not, and $\Theta(\theta, \theta) > \theta$, this makes collaboration more attractive, since Proposition 1 applies.

The allocation of credit for coauthored papers is an issue in itself. Some credit an author of a paper with N coauthors with $1/N$ of credit, some argue that having coauthors is

[12] An extension with an imperfect matching process is straightforward and will need additional assumptions. For instance, the collaboration of the junior faculty member and a well-established professor, unlike our simpler perfect matching, is quite frequent, but so much richer strategically, that it cannot be contained in a short extension and warrants a separate study. Uneven sharing of both effort and credit will go part and parcel with a layer of reputation building, and all these considerations are complementary to our current model.



(a) Large θ



(b) Small θ

NOTE: On Figures 5a–5b, dotted lines represent the change of the marginal benefit due to an introduction of γ and a decrease of per-person marginal costs of total effort. The total effort is higher in collaboration ($A > B$, both subfigures), but the per-person effort can decrease if θ is large ($A > C$ on Figure 5a, but not on Figure 5b) or if γ is too small ($A > C'$, both subfigures).

Figure 5: Effort under Coauthorship

not a reason to discount publications.[13] Here we will assume that each of two coauthors obtains the credit of $\gamma \leq 1$ single-authored papers.

Let the effort of two coauthors be expected to be equal. Then the cost of coauthorship is $2c(e/2)$, and the fictitious author[14] maximizes

$$\max_e 2\gamma\left(1 - [1 - \delta\bar{u}]F(\hat{q} - \theta - e)\right) - 2c(e/2).$$

This utility is split equally between two authors. Denote $e^{**}(\theta)$ to be the effort choice for the collaboration problem; analogously to Proposition 1, $\theta + e^{**}(\theta)$ is increasing.

Result 7. *Effort in coauthored papers is higher for all authors when $\gamma = 1$. As γ decreases, all coauthors exercise less effort.*

Easier effort motivates those with little chances of success by themselves, but allows most able authors to give up some efforts.

Result 8. *For $\gamma = 1$, collaborative effort per person is higher than in* solo *authoring for low-ability authors, and lower for high-ability authors.*

[13] Bikard et al. (2013) estimates the weight to be more corresponding to $1/\sqrt{N}$ than other alternatives.

[14] This is the first-best effort allocation outcome. We abstain from the discussions of free-riding equilibrium outcomes, and we abstain from discussions of how would the results change if N agents were collaborating simultaneously, for brevity.

When γ is less than 1, highly-able authors, whose probability of *solo* publication is close to γ without any efforts, prefer to publish *solo*: the collaboration-penalty is detrimental to their effort saving benefits.

Result 9. *For almost every θ, there is a small enough $\gamma > 0$ that will make collaboration less attractive than* solo *authorship.*

Since $c'(\cdot)$ is an arbitrary increasing function, we cannot further establish the pattern of collaboration when $\gamma < 1$ without loss of generality. We can, however, attempt to characterize what happens with comparative tendency to collaborate as $\theta \to -\infty$, which does not have to have a positive mass in the population of authors.

Result 10. *If $\gamma < 1/2$, least able authors prefer to work* solo*.*

The cutoff $\frac{1}{2}$ in the previous Result is a sufficient, not a necessary boundary. Particularly, such a low γ will drive the *total* collaborative productivity below the individual productivity for low enough θ. The proof would still work if γ was chosen so that *per person* collaborative productivity was driven below the individual productivity.

The low-ability authors, even if they submit, might not experience a sufficient economy of effort costs to warrant a higher choice of effort: they chose low effort because they could not hope for a decent chance to publish their work, and they still cannot. Furthermore, their publication will yield only γ of the *solo* publication. Thus, the intermediate ability agents are the most likely collaborators.

The total quantity of submissions can decrease if some of the collaborating authors would otherwise submit *solo*, but might increase if the set of potential collaborators includes the indifferent author type. The average quality of submitted and published papers, net of entry, will increase; the proportion of rejections, net of entry, might decrease, because the total effort on multi-author papers is higher, and therefore the quality of high-quality papers might increase.

3.4 Feedback from Refereeing

Referees of journals are frequently authors of papers published in the very same journals. Many factors affect their efficiency; a few interact with the submission outcomes.

The referee load, which is related to the amount of submissions, is unlikely to improve the referee's efficiency. The increase in workload, holding the quality of work constant, will make the time to finish work longer, and the maintenance of the same referee report deadline times will decrease the quality of reports. As with any tradeoffs, most likely a small worsening in both dimensions is going to be optimal. Every Result that leads to the increase of submissions is then likely to increase the noiseness of referee reports α, or to increase the time costs. Some results are reinforced by this feedback. For instance, an exogenous increase in α leads to more submissions (see Proposition 2), which will increase the load to referees.

The writing of referee reports and the writing of the original research is likely to involve similar human resources. Therefore, a higher marginal cost of the authoring effort is likely to increase the marginal cost of refereeing effort.

The most mysterious part of the refereeing process is the motivation of referees to produce informative signals. Our model provides an indirect explanation: able authors are hurt by a decrease in refereeing quality, and less able authors start to submit. Since most able authors can recognize the value in contributing to a public good (or at least in demotivating less able authors from submitting), they could be motivated to provide the refereeing services for free even if they don't explicitly care about the journal's quality.

3.5 Editor's Opinions

Editors are frequently prominent scholars themselves, and can formulate their own opinion about the paper before sending it off to the referees. Any *ex ante* positive signals will make the editor more welcoming. In the context of the model, getting a positive signal about a paper in addition to the referee's signal will move the admission threshold down.

The editor can use the *ex ante* signal to decide on whether to send the paper to referees for additional evaluation. If the editor cares about the quantity of referee reports (for instance, because overloaded referees cannot work as quickly), this creates a strategy space for the editor: only papers of intermediary quality will be sent to referees for the signal refinement, a high independent signal about the paper quality might qualify for desk accept, and a low independent quality signal can lead to a desk reject.[15]

Some signals of the editor might be public information. For instance, author's affiliation is well-known or easily obtainable, and arguably informative about the author's ability, and, consequently, about the quality of the author's paper. This will discourage authors with high independent signals from exercising effort: after all, they know that the editor will treat them favorably. This might discourage able authors with unfavorable public signals from submission. An affirmative action policy, with lower admission standard for authors of worse publication record, might induce higher effort among both low ability authors with unfortunate signals and high-ability authors with strong signals. Past publication record is another example of public information signaling, and some authors would rather not publish a paper in a second-tier journal after a rejection from the first-tier journal to ease their future publication chances, with disastrous consequences for tenure. Blind refereeing, even though impossible to implement perfectly due to the existence of Google, is still followed by many journals, and this might well be the reason.

4 Discussion

4.1 Policy Implications

Every policy implication will need, besides a good understanding of the authors' motivation, the understanding of the public benefit from publications, the understanding of the

[15]Too low precision of the independent signal might worsen the journal's performance compared to the journal whose editor has no independent signals: able authors will flock to the journals with less chances of random desk rejections, and unable authors will be attracted by the perspective of getting their papers desk-accepted, even if they stand little chance after the referee review.

editors' motivation, and the understanding of the payoff of the author from the publication (currently normalized to 1). The editor is concerned with better readership; the society is interested in better research quality; the author is interested in signaling his own ability and disseminating his own ideas. Every change in the market for publications affects the components of society's, editor's and author's welfare differently. The amount of submissions, the amount of refereeing, the efforts and ability of differently able authors accepted for publication: stronger results can be established with a better understanding about how these factors contribute to the society, to the editor and to the author. For instance, the editor that maximizes the average ability of his authors, without any regard for the benefit to society, can set an extremely high publishing standard: she can publish one paper in 10 years, but be sure that the average ability is arbitrarily high. The author probably cares less about the referee load than the editor. We, however, can make some statements about how the components of society, the editor, and the author's welfare changes.

More Open-Sourced Journals Many authors (e.g. Bergstrom (2001)) call for more open-sourced journals, to increase competition with for-profit journals, to motivate shorter refereeing delays or to drive down the fees for libraries. Assuming that new journals will recruit the necessary editorial reviewing resources, they will be in the situation of second-but-same journal, discussed above: the effort level of the most able authors will decrease, the amount of submissions will increase, and higher total capacity will drive down publication standards. Even if publication standards remain unchanged, having more journals lowers research effort. To attract the best authors, new journals should generate higher payoffs from publication than for-profit journals. Without that, or sabotaging old journals, however, having more journals in the short run will deteriorate the incentives of the most able authors.

Refereeing Delays Many authors discuss the potential of monetary incentives to decrease refereeing delays (Engers and Gans (1998); Chang and Lai (2001)), treating the delays as referees' leisure. However, refereeing is deeply intertwined with publishing, and many aspects of it are not contractable. Lowering time delays in a way that worsens the quality of referee reports will benefit only less able authors; lowering time delays so that the quality of refereeing is improved will benefit more able authors—and some of them will exert more effort—potentially improving the quality distribution of publications.[16]

Many Referees Obtaining reports of multiple referees provides a better estimate of a paper's virtues, but increases the load on the refereeing body, potentially lowering the quality of the referee reports. Editors can vary the number of referees for each individual paper, depending on preliminary evaluations: papers sufficiently far away from the acceptance threshold might get one reviewer to confirm the editor's preliminary opinion, whereas papers on the verge of the acceptance-threshold can have more reports[17], requested sequentially or simultaneously. The effects on the effort are straightforward: those authors who expect higher scrutiny—the authors whose papers are more likely to be perceived as the ones near the threshold—will exercise just enough efforts to be above the threshold, whereas those whose outcome is likely to be determined solely by the editor are likely to exert more effort.

Useful Referees We limit the involvement of referees by evaluation. Opinions on whether referees contribute to the quality of articles vary. If they do, even in a stochastic sense, referees' assistance will be most beneficial to those who are below the acceptance threshold. If referees' effort is costly, they will only exert it for papers sufficiently close to the acceptance threshold. This will lower the effort of authors, since they know that referees will attempt to "fix" their papers.

Single-, Double- and Triple-Blind Inferring the paper's quality from the identity or affiliation of the author might improve the publication process. It is easier to obtain a signal of equal quality if more information is available *ex ante*. This, however, is likely to worsen the stimuli for information acquisition for the referees: if the *ex ante* signal is very

[16] One way to achieve the latter is to make it easier to quantify the refereeing impact of a scholar. Administrators can aggregate information about publications and citations, but not about refereeing engagement. Some journals provide names of those who provided a referee report in their annual reports; some journals have an award for the best referee report; some journals employ their best referees as editors. However, many economists do not put their refereeing contribution into their CV: they think the informational content of refereeing contribution is not valuable.

[17] One of the authors is aware of an instance in which 5 referees were employed in a single round.

persuasive, why spend time on reading the paper? For these reasons, it might or might not be useful to inform referees about the identity of the author. One could argue one step further: is it really necessary for the editor to know the authors' name and affiliation?..

4.2 Job Market Implications

Job market decisions such as hiring involves forming expectations based on fuzzy signals. References provided by job market candidates are often coming from faculty members of the PhD program they graduate from. Grades from PhD programs are usually not very informative. PhD theses are usually unfinished during the job-market season. Having a publication in a top journal is usually informative but unlikely. What information can the search committee extract from papers that candidates report as "submitted"?

A submission into a field journal, interpreted as a first submission, could indicate that the candidate is not of top quality; submission to a less demanding second tier journal is an even worse signal. However, based on our model, demonstrating a submission to a field journal might be a better signal than having a submission to a general interest journal: the submitter to a general interest journal becomes a risky choice for hiring committees, since both high- and low-ability authors submit to general interest journals.

In a similar spirit, collaboration in authorship of submitted papers is a bad signal if other signals are favorable, but might be better than having solo submissions if other signals are unfavorable. Same holds for evidence of hard effort: the highest effort is exercised by authors near the acceptance threshold, not by those much above. Authors who prefer to not resubmit their articles after rejection from top journals to less rewarding journals are probably of intermediate quality.

For very unfortunate references, little can be done to update hiring committee's beliefs towards ability above intermediate, and multiple-authored papers submitted to field journals could be the best strategy.

These suggestions, obviously, hold only if all candidates are not manipulating submissions to improve their job market chances. If candidates do submit their papers to improve their job market chances, does that affect candidates' publication outcomes in the long run, especially taking into account tenure decisions?..

4.3 Reinterpretations and Reformulations

The part of the referee's signal that we label as "noise" might be beneficial if it is a measure of the taste of the journal's readers. The "noise" of accepted papers is more likely to be positive. For field journals this "noise" can be the field relevance, which might be a part of the profession's welfare; in this case, when considering re-submissions, the question of "noise" correlation across journals is an issue. Even for general interest journals, this "noise" might be the eloquence of the writing, the ease of presentation, and the clarity of graphs, which might be beneficial for the profession as well. It can also be the congruence with the current mainstream, which might be less beneficial for the long-run development of the profession, but satisfying in the short-run. Depending on the benefit of total referees' "noise" in published and rejected papers, different outcomes can become attractive.

We did not discuss the complementarity of the authors' ability and effort. Under complementarity, the quality of submitted paper will still be monotone in ability, and many results that hinge on that remain. Effort might not decrease with ability anymore, but many of the results discussed above do not depend on that.

We did not consider author heterogeneity beyond ability and editors' prior. Some authors might have a higher reservation utility as an alternative to publication; these authors will submit less and spend less effort, since the marginal payoff from publication is smaller for them. Some authors might have higher time costs, for instance, authors with looming career deadlines; these authors are motivated to increase their efforts, but will submit more papers, which will lower their efforts.

5 Conclusion

In our study, we supplied a general model of for the publication market. Using it, we reconciled various stylized facts which characterize differences in Economics over time and against other disciplines. The main takeaway message of our study is that the heterogeneity of authors with regard to their ability leads to different effects of changes in the publication process' fundamentals. For one, we explain why able authors are taking the effectively non-paid refereeing job: they are the ones who benefit from the overall improvement of the refereeing technology. The separation of authors into "more able" and "less able" is endogenous in our model, and it depends on the admission criterion that the editor applies. Not all separations are monotone: if some authors prefer to submit to field journal first, even if more valuable general interest journals require the same cutoff, these authors are likely to be of an intermediate ability. Hence, for many changes in the fundamentals, there are winners and losers. A claim about an inherent benefit of a change requires an implicit assumption about the comparative importance of the actors.

Our model does not impose a lot of structure on the underlying institutional processes, and its predictions can be applied directly to other contexts where agents compete for limited slots. For instance, job market applicants exert effort to overcome an interviewer's expectations regarding acceptable candidates. A model similar to ours will predict in that context that the most effort will be exerted by applicants marginally below the acceptance threshold, which in turn has implications on job market search duration. Other contexts include politicians competing for electorates, start-up businesses pursuing venture funding for their projects, real estate agents actively pushing their properties, and courtship in marital market—any context where effort changes perceived quality of a good offered to another party will inherit the intuition we provide in our model.

References

Atal, V. (2010). Do journals accept too many papers? *Economics Letters 107*(2), 229–232.

Azar, O. H. (2005). The review process in economics: is it too fast? *Southern Economic Journal 72*(2), 482–491.

Barbos, A. (2014). Imperfect evaluation in project screening. *Journal of Economics 112*(1), 31–46.

Bardhan, P. (2003). Journal publication in economics: a view from the periphery. *The Economic Journal 113*(488), F332–F337.

Bergstrom, T. (2001). Free labor for costly journals? *Journal of Economic Perspectives 15*(4), 183–198.

Bikard, M., F. E. Murray, and J. Gans (2013, April). Exploring tradeoffs in the organization of scientific work: Collaboration and scientific reward. Working Paper 18958, NBER.

Blank, R. M. (1991). The effects of double-blind versus single-blind reviewing: Experimental evidence from the American Economic Review. *American Economic Review 81*(5), 1041–1067.

Bornmann, L. (2011). Scientific peer review. *Annual Review of Information Science and Technology 45*(1), 197–245.

Card, D. and S. DellaVigna (2013). Nine facts about top journals in economics. *Journal of Economic Literature 51*(1), 144–161.

Chang, J.-j. and C.-c. Lai (2001, Oct). Is it worthwhile to pay referees? *Southern Economic Journal 68*(2), 457–463.

Cotton, C. (2013). Submission fees and response times in academic publishing. *The American Economic Review 103*(1), 501–509.

Ellison, G. (2002). The slowdown of the economics publishing process. *Journal of Political Economy 110*(5), 947–993.

Ellison, G. (2011). Is peer review in decline? *Economic Inquiry 49*(3), 635–657.

Engers, M. and J. S. Gans (1998, Dec). Why referees are not paid (enough). *American Economic Review 88*(5), 1341–1349.

Hamermesh, D. S. (1994). Facts and myths about refereeing. *The Journal of Economic Perspectives 8*(1), 153–163.

Hamermesh, D. S. (2013). Six decades of top economics publishing: Who and how? *Journal of Economic Literature 51*(1), 162–172.

Heintzelman, M. and D. Nocetti (2009). Where should we submit our manuscript? An analysis of journal submission strategies. *The BE Journal of Economic Analysis & Policy 9*(1), 1–26.

Laband, D. N. (1990). Is there value-added from the review process in economics?: Preliminary evidence from authors. *The Quarterly Journal of Economics 105*(2), 341–352.

Laband, D. N. and M. J. Piette (1994). A citation analysis of the impact of blinded peer review. *Journal of American Medical Association 272*(2), 147–149.

Leslie, D. (2005). Are delays in academic publishing necessary? *American Economic Review 95*(1), 407–413.

Medoff, M. H. (2003). Editorial favoritism in economics? *Southern Economic Journal 70*(2), 425–434.

Oster, S. (1980). The optimal order for submitting manuscripts. *The American Economic Review 70*(3), 444–448.

Weitzman, M. L. (1979). Optimal search for the best alternative. *Econometrica 47*(3), pp. 641–654.

Welch, I. (2014). Referee recommendations. *Review of Financial Studies 27*(8), 1–29.

A Proofs

Lemma 1. *If there are two solutions to the effort choice problem at* θ_0, $\lim_{\theta \to \theta_0 -} < \lim_{\theta \to \theta_0 +}$.

Proof. Consider Figure 1d: only points A and C can be maxima. Point B is a local minimum, because marginal benefit is less than marginal cost on the distance from A to B, and positive on the distance from B to C. If there are two maxima, it means that the total benefit of going from A to B is equal to the total loss due to movement from B to C.

The total loss from moving from A to B is decreasing with θ: the lower boundary, the $MB(e)$ curve, is shifting left, leaving less space in between. The benefit of moving from B to C, on the other hand, is decreasing: since $c'(e)$ is increasing, the original benefit of moving from B to C is a subset of the benefit of movement from B to C after the increase in θ, and therefore point C becomes more attractive. Thus, an increase in θ cannot lead to a "jump down". This immediately extends to the case of multiple intersections of MB and MC. □

Result 1. The monotonicity of the optimal effort corresponds directly to the monotonicity of $f(\cdot)$. When the solution of (1) is unique, the proof is immediate from Figures 1b and 1c (dotted lines show what happens to the $MB(e)$ curve when θ increases). If for some θ optimal effort started to decrease with θ, it will be decreasing for $\theta' > \theta$ by single-peakedness of $f(\cdot)$, and for the same reason if for some θ optimal effort increases with θ, it will be increasing for $\theta' < \theta$. Finally, observe that multiple solutions can only happen when one of the solutions in the domain of the "increasing" part of $MB(e)$ curve; apply Lemma 1 to finish the proof. The part about the derivative is obtainable from completely differentiating (1). □

Proposition 1. When the solution of the effort choice problem is unique, we can apply the implicit function theorem. Differentiate (1) with respect to θ:

$$-\frac{1-\delta\bar{u}}{\alpha^2}f'\left(\frac{\hat{q}-\theta-e}{\alpha}\right)\left(1+\frac{de^*(\theta)}{d\theta}\right) = c''(e^*(\theta))\frac{de^*(\theta)}{d\theta}.$$

The derivative of $\theta + e^*(\theta)$ is

$$1+\frac{de^*(\theta)}{d\theta} = 1+\frac{-\frac{1-\delta\bar{u}}{\alpha^2}f'\left(\frac{\hat{q}-\theta-e}{\alpha}\right)}{c''(e^*(\theta))+\frac{1-\delta\bar{u}}{\alpha^2}f'\left(\frac{\hat{q}-\theta-e}{\alpha}\right)} = \frac{c''(e^*(\theta))}{c''(e^*(\theta))+\frac{1-\delta\bar{u}}{\alpha^2}f'\left(\frac{\hat{q}-\theta-e}{\alpha}\right)}.$$

The denominator is positive because of the second order condition (2), the whole fraction is positive because $c(\cdot)$ is convex. □

Result 2. The change in $\hat{q}$ is mathematically the same as the change in θ, except that the sign is reversed. Single-peakedness of effort yields the result. The utility part of the statement is obtained with the Envelope theorem. □

Result 3. Consider first the effects of the changes in δ and $\bar{u}$ on effort choice and utility. Since (1) depends on the product of δ and $\bar{u}$, establishing the result for δ would be sufficient. Differentiate (1) completely with respect to δ:

$$-\frac{\bar{u}}{\alpha}f\left(\frac{\hat{q}-\theta-e^*(\theta)}{\alpha}\right)+\left(\frac{1-\delta\bar{u}}{\alpha^2}f'\left(\frac{\hat{q}-\theta-e^*(\theta)}{\alpha}\right)\right)\left(-\frac{\partial e^*(\theta)}{\partial\delta}\right) = c''(e^*(\theta))\frac{\partial e^*(\theta)}{\partial\delta} \Rightarrow$$

$$\frac{\partial e^*(\theta)}{\partial\delta} = \frac{-\frac{\bar{u}}{\alpha}f\left(\frac{\hat{q}-\theta-e^*(\theta)}{\alpha}\right)}{\underbrace{c''(e^*(\theta))+\frac{1-\delta\bar{u}}{\alpha^2}f'\left(\frac{\hat{q}-\theta-e^*(\theta)}{\alpha}\right)}_{>0 \text{ because it's SOC (2)}}} < 0.$$

Simultaneously, the Envelope theorem suggests that authors are better off:

$$\frac{\partial}{\partial \delta}\left(1-[1-\delta\bar{u}]F\left(\frac{\hat{q}-\theta-e^*(\theta)}{\alpha}\right)-c(e^*(\theta))\right)=\bar{u}F\left(\frac{\hat{q}-\theta-e^*(\theta)}{\alpha}\right)\in[0,1).$$

The derivative is equal to zero if and only if $\bar{u}=0$. The paper gets submitted if

$$1-[1-\delta\bar{u}]F\left(\frac{\hat{q}-\theta-e^*(\theta)}{\alpha}\right)-c(e^*(\theta))\geq\bar{u}.$$

Notice that the right-hand side increases one-to-one with $\bar{u}$, and does not change with δ. Since the left-hand side increases slower than one-to-one, the result follows. □

Proposition 2. The increase in α "flattens" the distribution (see Figure 2a) similarly to the way an increase in δ lowered efforts. For a single-peaked $f(\cdot)$, "flattened" distribution always has two intersections with the original distribution. However, unlike the change in δ, an increase in α also "stretches" the distribution sideways. When $f'(0)=0$, "flattened" distribution still has the maximum at 0, and two intersections of "before" and "after" curves are on the opposite sides of the vertical axis. For θ_0, the effect of the lowering level ($\frac{1}{\alpha}$ in front of $f(\cdot)$) dominates the effort-increasing stretching effect ($\frac{1}{\alpha}$ in the argument of $f(\cdot)$); if the original effort was chosen so that q is in the neighborhood of $\hat{q}$, the effort will decrease. Outside this neighborhood, the stretching effect dominates, and the effort of authors whose ability was much larger or much smaller than in the neighborhood of $\hat{q}-q\approx 0$ will have to increase (see Figures 2b and 2d).

Take a derivative of the change in the probability of publication with respect to α:

$$\left(1-[1-\delta\bar{u}]F\left(\frac{\hat{q}-\theta-e^*(\theta)}{\alpha}\right)\right)'_{\alpha}=-[1-\delta\bar{u}]f\left(\frac{\hat{q}-\theta-e^*(\theta)}{\alpha}\right)\frac{\alpha(-\frac{de^*}{d\alpha}(\theta))-(\hat{q}-\theta-e^*(\theta))}{\alpha^2}.$$

Solve for $\frac{de^*}{d\alpha}(\theta)$ by totally differentiating (1), and evaluate at $\alpha=1$:

$$\frac{d[P(\tilde{q}>\hat{q})]}{d\alpha}|_{\alpha=1}=\overbrace{[1-\delta\bar{u}]f\left(\hat{q}-\theta-e^*(\theta)\right)}^{>0}\left(\frac{de^*}{d\alpha}(\theta)+\hat{q}-\theta-e^*(\theta)\right).$$

Therefore, the sign of the change in probability is governed by

$$sgn\frac{d[P(\tilde{q}>\hat{q})]}{d\alpha}|_{\alpha=1}=sgn\left[\frac{de^*}{d\alpha}(\theta)+\hat{q}-\theta-e^*(\theta)\right]=sgn\frac{\frac{1}{[1-\delta\bar{u}]}c''(e^*(\theta))-f(\hat{q}-\theta-e^*(\theta))}{\underbrace{\frac{1}{[1-\delta\bar{u}]}c''(e^*(\theta))+f'(\hat{q}-\theta-e^*(\theta))}_{>0}}.$$

When θ is very large or very small, $f(\hat{q}-\theta-e^*(\theta))$ converges to zero, and the sign of $\frac{d[P(\tilde{q}>\hat{q})]}{d\alpha}$ is positive. For $\theta=\theta_0$, the value of density $f(\cdot)$ is maximal. $\frac{d[P(\tilde{q}>\hat{q})]}{d\alpha}$ will be negative if $[1-\delta\bar{u}]f(0)$ is larger than the second derivative of the effort cost function for the $\theta=\theta_0$ author.

The Envelope theorem provides

$$\frac{\partial}{\partial\alpha}\left(1-[1-\delta\bar{u}]F\left(\frac{\hat{q}-\theta-e^*(\theta)}{\alpha}\right)-c(e^*(\theta))\right)=\frac{1-\delta\bar{u}}{\alpha^2}\left(\hat{q}-\theta-e^*(\theta)\right)f\left(\frac{\hat{q}-\theta-e^*(\theta)}{\alpha}\right).$$

Since $\theta+e^*(\theta)$ increases in θ, authors with high enough θ will have $\hat{q}-\theta-e^*(\theta)$ negative, rendering the sign of the derivative negative. Reverse holds for small θ authors, for which $\hat{q}-\theta-e^*(\theta)>0$. □

Result 4. Since $F(\hat{q}-\theta-e^*(\theta))$ decreases in θ, $1-\delta+2\delta F(\hat{q}-\theta-e^*(\theta))[1-\delta\bar{u}]$ decreases in θ too. Consider the limits:

$$\lim_{\theta\to-\infty}1-\delta+2\delta F(\hat{q}-\theta-e^*(\theta))[1-\delta\bar{u}]=1+\delta-\delta^2\bar{u}>1-\delta\bar{u},$$

$$\lim_{\theta\to+\infty}1-\delta+2\delta F(\hat{q}-\theta-e^*(\theta))[1-\delta\bar{u}]=1-\delta<1-\delta\bar{u}.$$

By the intermediate value theorem, there is $\check{\theta}$ where

$$1-\delta+2\delta F(\hat{q}-\check{\theta}-e^*(\check{\theta}))[1-\delta\bar{u}]=1-\delta\bar{u},$$

and by the monotonicity of the left-hand side, it is unique. The agent of this type will choose the same effort level in both worlds, one journal or two journals. For all $\theta<\check{\theta}$, the marginal benefit of effort has increased: even though getting published at one place is unlikely, with two journals, the chance of getting accepted *somewhere* improve. At the same time, for $\theta>\check{\theta}$, the insurance motive for exercising effort is weaker.

Since $F(\hat{q}-\check{\theta}-e^*(\check{\theta}))=\frac{1}{2}\frac{1-\bar{u}}{1-\delta\bar{u}}$, the author whose chance of publication is 1/2 will decrease his effort, as will all authors of higher ability, and some of the authors of ability lower than that. □

Result 5. Assume submitting to journal 2 is better than abstaining:

$$\gamma(1-F)+F\delta\bar{u}-c(e)\geq\bar{u},$$

where $F=F(\hat{q}-\theta-e)\in(0,1)$ for some e. Then using same effort provides a higher utility, if one attempts resubmission to journal 1:

$$\gamma(1-F)+F\delta\overbrace{(1-F+F\delta\bar{u})}^{>\bar{u}+c(e)}-c(e)=\gamma(1-F)+F\bar{u}-c(e)\geq\gamma(1-F)+F\delta\bar{u}-c(e)\bar{u}.$$

Finally, observe that sending first to journal 1 is strictly better:

$$1-F+F\delta\left(\gamma(1-F)+F\delta\bar{u}\right)-c(e)=\overbrace{\gamma(1-F)+F\delta\left(1-F+F\delta u\right)-c(e)}^{\text{Utility of submitting to 2 first}}+\gamma(1-F)(1-F\delta).$$

However, some authors might find it optimal to not resubmit if they get a rejection after submission to journal 1. Consider $\check{\theta}$ such that

$$1-\check{F}+\check{F}\delta\bar{u}-\check{c}=\bar{u},$$

where $\check{c}=(e^*(\check{\theta}))$, $e^*(\cdot)$ solves (1), and $\check{F}=F(\hat{q}-\check{\theta}-e^*(\check{\theta}))$. If this author gets a rejection from Journal 1, he finds it optimal to resubmit to the second Journal only if

$$\gamma(1-\check{F})+\check{F}\delta\bar{u}\geq\bar{u}.$$

Obviously, if $\gamma<\bar{u}$, this never holds. When $\gamma>\bar{u}$, this inequality, after substitution of the indifference condition, produces

$$\frac{\gamma-\bar{u}}{\gamma-\delta\bar{u}}\leq\frac{1-\bar{u}-\check{c}}{1-\delta\bar{u}},$$

which holds if $\gamma\geq\frac{1-\delta+\delta\check{c}}{\bar{u}(1-\delta)+\check{c}}\bar{u}$. Finally, observe that when $\gamma=1$, all authors resubmit, and when $\gamma=\bar{u}$, no one resubmits. Since the utility of resubmission is continuous in γ, the threshold γ, established above, has to be above $\bar{u}$. □

Proposition 3. Consider the choice between submitting first to journal 1, then to journal 2 (strategy 1), and submitting first to journal 2, then to journal 1 (strategy 2). Consider the effort choice problem when choosing strategy i; let $e_i^*(\theta)$ denote the effort chosen by the author of type θ.

The utility from submitting to journal 1 first is

$$U_1=1-F(\hat{q}_1-\theta-e_1^*(\theta))+F(\hat{q}_1-\theta-e_1^*(\theta)\delta\left(\gamma(1-F(\hat{q}_2-\theta-e_1^*(\theta)))+F(\hat{q}_2-\theta-e_1^*(\theta))\delta\bar{u}\right)-c(e_1^*(\theta)).$$

The utility from submitting to journal 2 first is

$$U_2=\gamma(1-F(\hat{q}_2-\theta-e_2^*(\theta)))+F(\hat{q}_2-\theta-e_2^*(\theta)\delta\left(1-F(\hat{q}_1-\theta-e_2^*(\theta))+F(\hat{q}_1-\theta-e_2^*(\theta))\delta\bar{u}\right)-c(e_2^*(\theta)).$$

When $\gamma=1$ and $\hat{q}_2=\hat{q}_1$, $e_1^*(\theta)=e_2^*(\theta)=e^*(\theta)$, and $U_1(\theta)=U_2(\theta)$. Consider a small change in γ at $\gamma=1$ and $\hat{q}_1=\hat{q}_2=\hat{q}$:

$$\frac{dU_1}{d\gamma}=\delta F(\hat{q}-\theta-e^*(\theta))(1-F(\hat{q}-\theta-e^*(\theta)))>0.$$

$$\frac{dU_2}{d\gamma} = 1 - F(\hat{q} - \theta - e^*(\theta)) > 0.$$

As in Result 5, lowering γ makes submitting to journal 2 first a strictly dominated strategy for every ability level:

$$\frac{d(U_1 - U_2)}{d\gamma} = (1 - F(\hat{q} - \theta - e^*(\theta)))\,(\delta F(\hat{q} - \theta - e^*(\theta)) - 1) < 0.$$

Consider a small change in $\hat{q}_2$, the admission standard of journal 2:

$$\frac{dU_1}{d\hat{q}_2} = \delta F(\hat{q} - \theta - e^*(\theta))(\delta\bar{u} - 1)f(\hat{q} - \theta - e^*(\theta)) < 0.$$

$$\frac{dU_2}{d\hat{q}_2} = (\delta\,[1 - F(\hat{q} - \theta - e^*(\theta)) + F(\hat{q} - \theta - e^*(\theta))\delta\bar{u}] - 1)f(\hat{q} - \theta - e^*(\theta)) < 0.$$

Lowering $\hat{q}_2$ makes submitting to journal 1 first a strictly dominated strategy:

$$\frac{d(U_1 - U_2)}{d\hat{q}_2} = f(\hat{q} - \theta - e^*(\theta))[1 - \delta] > 0.$$

To model a simultaneous decrease in $\hat{q}_2$ and γ, express the relative change in γ with $\lambda \in (0, 1)$, and consider

$$\lambda\frac{-d(U_1 - U_2)}{d\gamma} + (1 - \lambda)\frac{-d(U_1 - U_2)}{d\hat{q}_2} = \lambda(1 - F(\cdot))(1 - \delta F(\cdot)) - (1 - \lambda)f(\cdot)[1 - \delta].$$

Strategy 1 is better than strategy 2 if it is positive:

$$[1 - \delta]\frac{1 - \lambda}{\lambda} < \frac{1 - F(\hat{q} - \theta - e^*(\theta))}{f(\hat{q} - \theta - e^*(\theta))}[1 - \delta F(\hat{q} - \theta - e^*(\theta))].$$

By log-concavity of $f(\cdot)$, $[1 - F(\cdot)]/f(\cdot)$ is decreasing. The product of two decreasing positive functions is decreasing, and therefore the inequality above holds for small enough $q - \theta - e^*(\theta)$. By monotonicity of $\theta + e^*(\theta)$, these are authors with large enough θ, they will submit to journal 1 first, and the rest will submit to journal 2 first. □

Proposition 4. See Figure 3 for illustration. Consider the choice between submitting first to general interest journal, then to field (strategy 1), versus submitting to field journal, then to general interest (strategy 2). Consider the effort choice problem when choosing strategy i; let $e_i^*(\theta)$ denote the effort chosen by the author of type θ.

The utility from submitting to journal 1 first is

$$U_1 = 1 - F(\hat{q} - \theta - e_1^*(\theta)) + F(\hat{q} - \theta - e_1^*(\theta)\delta\left(\gamma(1 - F(\frac{\hat{q} - \theta - e_1^*(\theta)}{\alpha})) + F(\frac{\hat{q} - \theta - e_1^*(\theta)}{\alpha})\delta\bar{u}\right) - c(e_1^*(\theta)).$$

The utility from submitting to journal 2 first is

$$U_2 = \gamma(\frac{1 - F(\hat{q} - \theta - e_2^*(\theta)}{\alpha}) + F(\frac{\hat{q} - \theta - e_2^*(\theta)}{\alpha})\delta\left(1 - F(\hat{q} - \theta - e_2^*(\theta))\right) + F(\hat{q} - \theta - e_2^*(\theta))\delta\bar{u}) - c(e_2^*(\theta)).$$

Assume $\gamma = 1$ and $\alpha = 1$, then $e_1^*(\theta) = e_2^*(\theta) = e^*(\theta)$, and both submission strategies are equally attractive. Consider the difference of the utility from the first submission strategy and the utility from the second submission strategy. Take a derivative with respect to α:

$$\frac{d}{d\alpha}(U_1 - U_2)|_{\alpha=1} = \delta\bar{u}\left[\hat{q} - \theta - e^*(\theta)\right] f(\hat{q} - \theta - e^*(\theta))[1 - F(\hat{q} - \theta - e^*(\theta))].$$

Since $\theta + e^*(\theta)$ is increasing, the sign of $[\hat{q} - \theta - e^*(\theta)]$ determines the sign of the whole expression. When θ is large enough, the whole expression is negative: able authors prefer submitting to a field journal.

Consider now a change in γ:

$$\frac{d}{d\gamma}(U_1 - U_2)|_{\gamma=1} = -(1 - F(\hat{q} - \theta - e^*(\theta)))^2.$$

To model the simultaneous decrease in α and γ, express the relative change in γ with $\lambda \in (0, 1)$, and consider

$$\lambda\frac{-d}{d\gamma}(U_1 - U_2) + (1 - \lambda)\frac{-d}{d\alpha}(U_1 - U_2)|_{\alpha=\gamma=1} = \lambda(1 - F(x))^2 + (1 - \lambda)\delta\bar{u}xf(x)[1 - F(x)],$$

where $x = \hat{q} - \theta - e(\theta)$. Authors of positive x (that is, with $\theta + e^*(\theta) < \hat{q}$) will prefer to pursue strategy 1 for every λ.

Take $\bar{x} < 0$, and pick $\lambda < \bar{\lambda}$, where

$$\bar{\lambda} = \frac{\delta\bar{u}\bar{x}f(\bar{x}_0)}{\delta\bar{u}\bar{x}f(\bar{x}) + 1 - F(\bar{x})}.$$

For this λ, agents in the neighborhood of $\bar{x}$ prefer strategy 2. On the other hand, as $x \to -\infty$ (that is, as $\theta \to +\infty$),

$$\lambda\frac{-d}{d\gamma}(U_1 - U_2) + (1 - \lambda)\frac{-d}{d\alpha}(U_1 - U_2)|_{\alpha=\gamma=1} \to \lambda,$$

since $xf(x)$ converges to zero at the extremes, so that ε can have a finite mean. Therefore, for every $\lambda > 0$, most able authors prefer submitting to the general interest journals. □

Result 6. Compare (1) and (3). Observe that $c'(2e) > c'(e)$, and therefore the per-paper effort has to be lower.

To calculate the total effort, denote $E = 2e$. Rewrite (3) as

$$[1 - \delta\bar{u}]f(\hat{q} - \theta - E/2) = c'(E). \tag{3'}$$

The right-hand sides of (1) and (3′) coincide.

For single-peaked $f(\cdot)$, the nonzero intersection of $f(\hat{q} - \theta - e)$ and $f(\hat{q} - \theta - e/2)$ is unique, denote it $\bar{e}(\theta)$. It is positive for small θ. Observe that $\bar{e}(\theta)$ decreases with θ until hits zero. If $\bar{e}(\theta) > e^*(\theta)$, because of single-peakedness of f, it has to be that $e_2^*(\theta) < e^*(\theta)$, and *vice versa*. □

Result 7. Consider first the case of $\gamma = 1$. By convexity of $c(\cdot)$, $2c(e/2) < c(e)$, and $\frac{d}{de}2c(e/2) = c'(e/2) < c'(e) = \frac{d}{de}2c(e/2)$. The marginal benefits of effort for collaborators and for *solo* authors are the same. At $e^*(\theta)$, however, collaborators have smaller marginal costs of effort than marginal benefits, hence $e^{**}(\theta) > e^*(\theta)$ when γ is 1. The Envelope theorem provides the second part of the Result. □

Result 8. In collaboration, the marginal costs of effort are smaller. For large θ, this corresponds to Figure 5a. The total effort becomes higher, but since the marginal benefit of effort in collaboration is lower, per-person effort is lower. For small θ, the relevant portion of $f(\cdot)$ is depicted on Figure 5b. Since the marginal benefit is locally increasing, the marginal benefit of effort in collaboration might be higher than if coauthors worked separately, hence the per-person effort is higher. Because the density is single-peaked, and $c'(e)$ is increasing, there is a threshold $\bar{\theta}$ where $MB(e^*(\theta)|\theta) < MB(e^{**}(\theta)|\theta)$ for all $\theta < \bar{\theta}$. □

Result 9. Observe that $e^{**}(\theta)$ is characterized by

$$[1 - \delta\bar{u}]f(\hat{q} - \theta - e^{**}(\theta)) = \frac{1}{\gamma}c'(e^{**}(\theta)/2).$$

One can always pick $\gamma = \bar{\gamma} > 0$ that provides

$$\frac{1}{\bar{\gamma}}c'(e^{**}(\theta)/2) = c'(e^*(\theta)).$$

For $\gamma = \bar{\gamma}$, the probability of publication *solo* is equal to probability of publication together, but the payoff from publication is only γ. Hence, publishing *solo* is strictly preferable. Smaller γ lowers the payoff from coauthoring, but not from publishing *solo*. □

Result 10. Denote $MB(e|\theta) = [1 - \delta\bar{u}]f(\hat{q} - \theta - e)$. Observe that $e^*(\theta)$ is characterized by

$$MB(e^*(\theta)|\theta) = c'(e^*(\theta)),$$

and $e^{**}(\theta)$ is characterized by

$$MB(e^{**}(\theta)|\theta) = {}^{1}\!/\!_{\gamma} c'(e^{**}(\theta)/2).$$

As $\theta \to 0$, the effort chosen by both ways converges to zero because $MB(e|\theta) \to_{\theta \to -\infty} 0$. θ, however, does not change the cost part of the effort choice. In the neighborhood of $e = 0$,

$$\frac{d}{de}\left(\frac{1}{\gamma}c'(e/2)\right)|_{e=0} = \frac{1}{2\gamma}c''(0),$$

which is larger than $c''(0) = \frac{d}{de}\left(c'(e)\right)|_{e=0}$ if and only if $\gamma > 1/2$. Therefore, when $\gamma > 1/2$, the collaborative total effort $e^{**}(\cdot)$ of very lowly able authors is higher than the *solo* effort $e^{*}(\cdot)$ of the same authors, and reverse holds if $\gamma < 1/2$.

The difference between utilities of collaboration and of *solo* submission is:

$$\left[\gamma\left(1 - [1 - \delta\bar{u}]F(\hat{q} - \theta - e^{**}(\theta)\right) - c(e^{**}(\theta)/2)\right] - \left[\left(1 - [1 - \delta\bar{u}]F(\hat{q} - \theta - e^{*}(\theta)\right) - c(e^{*}(\theta))\right].$$

The derivative of this with respect to θ, applying the Envelope theorem twice, and using FOCs to replace $f(\cdot)$ with $c'(\cdot)$, is

$$\gamma[1-\delta\bar{u}]f(\hat{q}-\theta-e^{**}(\theta)-[1-\delta\bar{u}]f(\hat{q}-\theta-e^{*}(\theta)) = c'(e^{**}(\theta)/2)-c'(e^{*}(\theta)) < c'(e^{**}(\theta))-c'(e^{*}(\theta)).$$

Since $c'(\cdot)$ is an increasing function, when $\gamma < 1/2$, the difference between the utility of collaboration and the utility of the *solo* submission is decreasing. Since the utilities of collaboration and *solo* writing approach 0 as $\theta \to -\infty$, the value of this difference is zero in the limit. Therefore, this difference is negative for small enough θ. It means that the *values* of these utilities are ordered in a very specific way for small enough θ: the utility of *solo* submission is higher than the utility of coauthorship. □

B Proofs and Robustness Checks Not For Publication

Cutoff rule for editor. Assume the editor chooses between papers whose signals are $\tilde{q}_1$ and $\tilde{q}_2$. The editor estimates the probability that paper 1 is better than paper 2:

$$P(q_1 > q_2) = P(\tilde{q}_1 - \alpha\varepsilon_1 > \tilde{q}_2 - \alpha\varepsilon_2) = P(\varepsilon_1 - \varepsilon_2 < (\tilde{q}_1 - \tilde{q}_2)/\alpha).$$

Since $\varepsilon_1 - \varepsilon_2$ is distributed symmetrically, the probability that paper 1 is better than paper 2 is bigger than 1/2 if and only if $\tilde{q}_1 > \tilde{q}_2$. The result extends to scenarios where the referees' noise is not additive and homoskedastic if the distribution of $\tilde{q}_i$ conditional on q_i features the MLRP property. □

Cutoff rule for the authors. Apply the Envelope Theorem to the effort choice problem knowing that the editor will apply a cutoff rule: the utility of publishing is increasing in θ. $\square$

Equilibrium existence and uniqueness. Consider the best responses of the editor (admission rule decision) and of the authors (participation decision). The increase in $\hat{\theta}$ lowers the submissions without the change in effort of those who submit. Therefore, less than T of papers produce the signal of $\hat{q}$, and therefore the best response function $\hat{q}(\hat{\theta})$ is a decreasing function. Simultaneously, an increase in $\hat{q}$ lowers the utility of submitters by the Envelope theorem; therefore, $\hat{\theta}$ increases in $\hat{q}$, and the inverse function is increasing as well. So, in the space of $(\hat{\theta}, \hat{q})$, one best response is decreasing, and another is increasing. The intersection is unique. The existence is straightforward. $\square$

Effort is well-defined. Since the payoff is bounded, concavity of the cost function guarantees that the effort is finite. Indeed, consider $e' > 0$: if $c(e') > 1$, the optimal effort needs to be less than e', and Berge's theorem applies. If not, consider $e'' = e' + \frac{1-c(e')}{c'(e')}$: by concavity of $c(\cdot)$, $c(e'') \geq 1$, with equality only if $c(\cdot)$ is linear in $[e', e'']$. Therefore, the optimal level of effort is bounded by e'', and Berge's theorem applies. $\square$

Effort is generally single-valued. Assume that at θ', $e^*(\theta')$ has two solutions. This means that the MB and MC curves intersect thrice, like on the Figure 1d (point B is a local minimum), and the area contained between two curves in the interval $e \in [A, B]$ (where marginal benefit is smaller than marginal cost) is equal to the area contained between two curves in the interval $e \in [B, C]$ (where marginal benefit is larger than marginal cost), and therefore the expected payoff when e is chosen at the point of A is the same as the effort chosen at the point of C. A small increase in θ shifts the MB curve to the left. That increases the area between MB and MC curves from B to C (where MB is larger than MC), and decreases the area between A and B, showing that there is a higher expected payoff from being in point C compared to being in point A. Similarly, one can show that a small decrease in θ leads to choosing A. Therefore, in a small enough punctured neighborhood of θ', $e^*(\theta)$ is single-valued, and therefore (by the lack of atoms in the distribution of $f(\cdot)$) the set of θ where $e^*(\theta)$ is two-valued has measure zero. The argument immediately generalizes to multiple-valued $e^*(\theta)$. $\square$

For two journals of same payoff and standard, authors submit to both journals sequentially. The result follows since the author knows the quality of his paper for sure, and does not learn from the rejection. Assume submitting once for evaluation is reasonable:

$$1 - F + F\delta\bar{u} - c(e) \geq \bar{u},$$

where $F = F(\hat{q} - \theta - e)$ for some e. Then, for the same effort,

$$1 - F + F\delta \overbrace{(1 - F + F\delta\bar{u})}^{\geq \bar{u} + c(e)} - c(e) > 1 - F + F\delta\bar{u} - c(e) \geq \bar{u}. \qquad \square$$

Proposition 1 persists with two journals. In a way similar to the proof in Proposition 1,

$$1 + \frac{\partial e^*(\theta)}{\partial \theta} = \frac{c''(e^*(\theta))}{c''(e^*(\theta)) + (1 - \delta)\, f'(\hat{q} - q) + 2\delta(1 - \delta\bar{u})\left(F(\hat{q} - q) f'(\hat{q} - q) - f^2(\hat{q} - q)\right)\right)} > 0.$$

where $q = \theta + e^*(\theta)$. $\square$

Robustness of results to additivity. For production function, we assumed that $q = \theta + e$. If instead we assumed that $q = \theta e$, we can take logs, and formulate our model in terms of

$$q' = \ln q, \theta' = \ln \theta, e' = \ln e \Rightarrow q' = \theta' + e'.$$

Properties like single-peakedness of the density and cutoff strategies remain under cutoff transformation. $c(\exp(e'))$ is convex as long as $c(\cdot)$ is convex.

For CES aggregation $q = (\theta^\kappa + e^\kappa)^{1/\kappa}$, one can substitute

$$q' = q^\kappa, \theta' = \theta^\kappa, e' = e^\kappa \Rightarrow q' = \theta' + e'.$$

For $\kappa > 0$, same logic applies. For $\kappa < 0$, it is harder to retain convexity of the transformed cost function, but it is evident that the space where results persevere remains non-trivial.

If θ instead of increasing the endowment of the paper quality was lowering the marginal costs of effort, and $q = e$ (or an increasing function of it), one can easily establish that under single-peakedness of ε, e increases with θ, which makes Proposition 1 easier to obtain. Since it is key to proofs of other results, it is likely that they survive as well (Proposition 2 survives for sure).

For a general endowment-effort aggregation, $q(\theta, e)$, Proposition 1 remains as long as an increase in θ does not decrease the marginal quality of effort application. This is a common (single-crossing) assumption in the literature.

For refereeing noise additivity, CES or Cobb-Douglas specification allows to revert to the additive structure: $\tilde{q} = (\theta^\kappa + e^\kappa + \varepsilon^\kappa)^{1/\kappa} \Rightarrow$

$$\tilde{q}' = q^\kappa, \theta' = \theta^\kappa, e' = e^\kappa, \varepsilon' = \varepsilon^\kappa \Rightarrow \tilde{q}' = \theta' + e' + \varepsilon'.$$

Single-peakedness of the density remains if the transformation is monotone, log-concavity is harder to preserve. $\square$

Two good journals are sufficient to study N journals. Assume that a publication in journal i yields γ_i unit of utility to an author. The author considers submitting his paper to journals $S \cup \{i, j\}$. The expected payoff of an author who submits to journal i first, to journal j afterwards, and then follows the optimal submission plan, is then

$$\gamma_i(1 - F_i) + F_i\delta\left(\gamma_j\left(1 - F_j\right)\right) + F_iF_j\delta^2U(S) - c(e),$$

where $F_i = F(\frac{\hat{q}_i - \theta - e}{\alpha_i})$, and $U(S)$ is the utility from submitting the paper to journals in the set S. Alternatively, journal j can be chosen as a first choice option:

$$\gamma_j(1 - F_j) + F_j\delta\left(\gamma_i\left(1 - F_i\right)\right) + F_iF_j\delta^2U(S) - c(e).$$

For every level of chosen effort, the first journal is preferable when the difference of the former payoff from the latter payoff is positive:

$$\gamma_i(1 - F_i) + F_i\delta\left(\gamma_j\left(1 - F_j\right)\right) > \gamma_j(1 - F_j) + F_j\delta\left(\gamma_i\left(1 - F_i\right)\right) \Rightarrow \gamma_i\frac{1 - F_i}{1 - \delta F_i} > \gamma_j\frac{1 - F_j}{1 - \delta F_j}.$$

Observe that $U(S)$ or S do not affect the choice in the ordering. For every submission sequence, either it is ordered by the ratio of the expected payoff to $1 - \delta P(\text{reject})$, or it can be improved[18]. For instance, in our two-good-one-bad journal case, submitting to journal 2 is better than sending off to a bad journal when

$$\gamma\frac{1 - F_2}{1 - \delta F_2} > \bar{u}\frac{1}{1 - \delta},$$

giving rise to Result 5 and Proposition 3. □

[18] This is the way Heintzelman and Nocetti (2009) adapts Weitzman (1979) argument on the optimal search sequence.