CHAPTER 3

Time preference submission model

In the previous chapter, we analyze the equilibriums of academic submission and publishing decision process assuming that the authors weight the future as the same as the present. In this chapter we relax some assumptions of the former basic model to extend our insight. In the following discussions, the time-preference would be introduced into the decision process. To be more specific, we discounts the expected payoffs of the delayed gains in the second run of submission with a common time factor δ which is positive and less than one. The impacts of the time cost on the decision of authors and the welfare analysis would be illustrated in this chapter.

3.1. The equilibrium with time preference

3.1.1. The decision of authors

With the same decision process as the Figure 2 in the previous chapter, the authors have the new expected payoffs with time-delay consideration of each submission strategies as follows,[5]

Sequentially submitting Journal 1 first

(3-1) $$V(J_1, J_2) = P_1R_1 + \delta(1 - P_1)P_2R_2$$

Sequentially submitting Journal 2 first

(3-2) $$V(J_2, J_1) = P_2R_2 + \delta(1 - P_2)P_1R_1$$

Multi-submission (if allowable)

(3-3) $$V(J_1 \& J_2) = P_1R_1 + P_2R_2 - P_1P_2R_2$$

[5] Again we assume that the authors will accept the acceptance of journal 2 when sole-submitting to journal 2 first for the similar reason as the model in chapter 2. The result can be also shown in the appendix.

Sole submission rule

In the case where only sole-submission rule is allowable, the available submission choices would be $V(J_1, J_2)$ and $V(J_2, J_1)$. And the authors will choose to sole-submit to Journal 1 first if the following condition holds.

$$V(J_1, J_2) > V(J_2, J_1)$$

$$P_1R_1 + \delta(1 - P_1)P_2R_2 > P_2R_2 + \delta(1 - P_2)P_1R_1$$

$$\frac{R_1}{R_2} > \frac{(1-\delta+\delta P_1)}{(1-\delta+\delta P_2)}\frac{P_2}{P_1}$$

To conjecture the submission decision of authors, we let the new value $\bar{\bar{q}}$ solves the following equation.

(3-4) $$\frac{R_1}{R_2} = \frac{(1-\delta+\delta P_1)}{(1-\delta+\delta P_2)}\frac{P_2}{P_1}$$

We can express $\bar{\bar{q}}$ as[6]

$$\bar{\bar{q}}(R_1, R_2, \delta)$$

For the convenience to analyze we let $\omega = \frac{(1-\delta+\delta P_1)}{(1-\delta+\delta P_2)}\frac{P_2}{P_1}$ and partial differentiate ω with respect to q, we have the following equation:

$$\frac{\partial\omega}{\partial q} = \frac{(1-\delta+\delta P_2)P_1[P_{2q}(1-\delta+\delta P_1)+P_{1q}P_2]-(1-\delta+\delta P_1)P_2[P_{1q}(1-\delta+\delta P_2)+P_{2q}P_1]}{(1-\delta+\delta P_2)^2{P_1}^2}$$

(3-5) $$\frac{\partial\omega}{\partial q} = \frac{(1-\delta)[P_1P_{2q}(1-\delta+\delta P_1)-P_2P_{1q}(1-\delta+\delta P_2)]}{(1-\delta+P_2)^2{P_1}^2}$$

In addition, we assume $P_{1q} = P_{2q}$ (quality's equal marginal contribution to acceptance), which reduces equation (3-5) to

(3-6) $$\frac{\partial\omega}{\partial q} = \frac{P_{1q}(1-\delta)[P_1(1-\delta+\delta P_1)-P_2(1-\delta+\delta P_2)]}{(1-\delta+\delta P_2)^2{P_1}^2}$$

[6] It is easy to show that $V(J_1, J_2)$ and $V(J_2, J_1)$ are monotone in q by differentiating both with respect to q.

The equation (3-6) is less than zero since $P_{1q} > 0$ and $P_1 < P_2$. That is,

$$(3\text{-}7) \qquad \begin{cases} V(J_1, J_2) > V(J_2, J_1), \text{if } q > \bar{\bar{q}} \\ V(J_1, J_2) \leq V(J_2, J_1)s, \text{if } q \leq \bar{\bar{q}} \end{cases}$$

With (3-7), we could know the authors with quality higher than $\bar{\bar{q}}$ would sole-submit to Journal 1 first, and the others would choose the reverse order which yields the following submission graph.

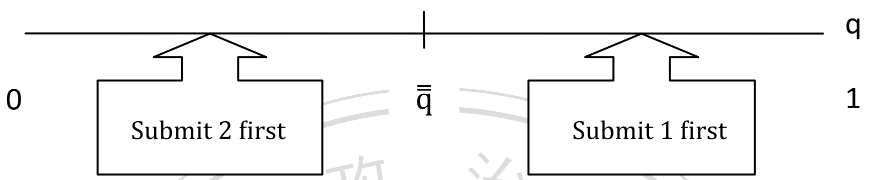

Figure3.1. the reaction of authors in sole-submission rule with time-delay consideration (simultaneously reply time)

Proposition 5. The effect of delay-time

When authors has a constant time-preference on the utility and the publishers referee the submissions with a similar speed, the authors with lower writing ability will submit the journal with lower reputation first in sole submission rule. And the more impatient the authors are the more papers will be submitted to the journal with lower reputation first.

Figure 3.1 shows that when the utility of getting papers being published decreases with the time delayed, the authors with lower writing ability (lower than $\bar{\bar{q}}$) would be in haste to see their papers published in journals and make them shift their submission strategy to submit the journal with lower reputation first. And we can show that the more impatient the authors are the more papers will be submitted to the journal with lower reputation first.

Proposition 6. The effect of the time factor

When authors has a constant time-preference on the utility and the publishers referee the submissions with a similar speed, the more impatient the authors are the more papers be sole-submitted to the less prestigious journal first.

Rearranging equation (3-4) we have,

$$K = P_1R_1 + \delta P_2R_2 - \delta P_1P_2R_2 - P_2R_2 - \delta P_1R_1 + \delta P_1P_2R_1$$

Partially differentiate K with respect to q,

$$\frac{\partial K}{\partial q}|_{\bar{\bar{q}}} = P_1'R_1 + \delta P_2'R_2 - \delta R_2(P_1'P_2 + P_2'P_1) - P_2'R_2 + \delta P_1'R_1 + \delta R_1(P_1'P_2 + P_2'P_1)$$

With the assumption $P_{1q} = P_{2q}$,

(3-8) $$\frac{\partial K}{\partial q} = \delta(P_1'P_2 + P_2'P_1)(R_1 - R_2) + P_1'(1-\delta)(R_1 - R_2) > 0$$

To differentiate K with respect to δ, we have

$$\frac{\partial K}{\partial \delta}|_{\bar{\bar{q}}} = P_2R_2 - P_1P_2R_2 - P_1R_1 + P_1P_2R_1$$

Given that $q = \bar{\bar{q}}$, we can derive the following result with the fact that $P_2R_2 > P_1R_1$

(3-9) $$\frac{\partial K}{\partial \delta}|_{\bar{\bar{q}}} = P_1P_2(R_1 - R_2) + P_2R_2 - P_1R_1 > 0$$

From equations (3-8) and (3-9), we have

(3-10) $$\frac{dq}{d\delta}|_{\bar{\bar{q}},K} = -\frac{\partial K}{\partial \delta}|_{\bar{\bar{q}}} / \frac{\partial K}{\partial q}|_{\bar{\bar{q}}} < 0$$

The implicit differentiation above implies that the more impatient the authors (lower δ) the larger the $\bar{\bar{q}}$ is which results in more authors sole-submit to Journal 2 first under sole-submission rule.

Multi-submission rule

If both publishers agreed with the multi-submission rule, we can show that multiple-submission is the best submission strategy for all authors with following comparisons.

$$P_1R_1 + P_2R_2 - P_1P_2R_2 > P_1R_1 + \delta(1 - P_1)P_2R_2$$

$$V(J_1 \& J_2) > V(J_1, J_2)\ \forall\ q$$

$$P_1R_1 + P_2R_2 - P_1P_2R_2 > P_2R_2 + \delta(1 - P_2)P_1R_1$$

$$V(J_1 \& J_2) > V(J_2, J_1)\ \forall\ q$$

All the authors will multiple-submit to both journals if the multiple-submission is the rule.

3.1.2. The decisions of journals

Knowing the reactions to the submission rules of authors, we could derive the payoffs of publishers under each submission as follows:

(i) Sole-submission (SS)

The Sole-submission rule will be formed if one of the publishers refuses to accept multiple-submission. The expected payoffs of both journals would be more complex than the previous model d due to an indeterminacy of $\bar{\bar{q}}$'s position with respect to z_1 and z_2. Given the criterions of both journals, we have following possible scenarios (3.a) $\bar{\bar{q}} < z_2 < z_1$, (3.b) $z_2 < \bar{\bar{q}} < z_1$ and (3.c) $z_2 < z_1 < \bar{\bar{q}}$ to discuss:

Case (3.a) $\bar{\bar{q}} < z_2 < z_1$

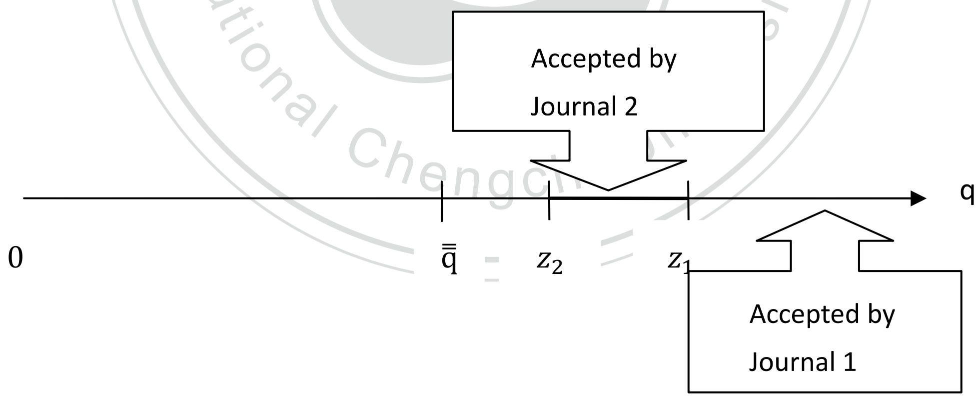

Figure 3.2. the papers selected by each journal (3.a)

Given the authors with ability above $\bar{\bar{q}}$ will sole-submit to Journal 1 first and others sole-submit to Journal 2 first, the papers with $q \in [z_1, 1]$ would be accepted and published by Journal 1 while those with $q \in [\bar{\bar{q}}, z_1]$ would be rejected and resubmitted to Journal 2. That is, Journal 2 would be allowed to screen the papers with $q \in [0, z_1]$. Those papers with $q \in [z_1, z_2]$ would be accepted by Journal 2. The total quantity of papers Journal 1 reviewed is $(1 - \bar{\bar{q}})$ plus the resubmitted volume $\bar{\bar{q}}$

and costs him totally c to referee. On the other hand, the load of Journal 2 should be the original $\bar{\bar{q}}$ plus the resubmitted $z_1 - \bar{\bar{q}}$ and costs her cz_1 to referee. Thereby, the expected payoffs of both journals would be:

(3-11) $$\pi_{ss}^{1}|_{\bar{\bar{q}}<z_2<z_1} = \frac{\beta}{2}(1 - z_1^2) - c$$

(3-12) $$\pi_{ss}^{2}|_{\bar{\bar{q}}\le z_1} = \frac{\beta}{2}(z_1^2 - z_2^2) - cz_1$$

Case (3.b) $z_2 < \bar{\bar{q}} < z_1$

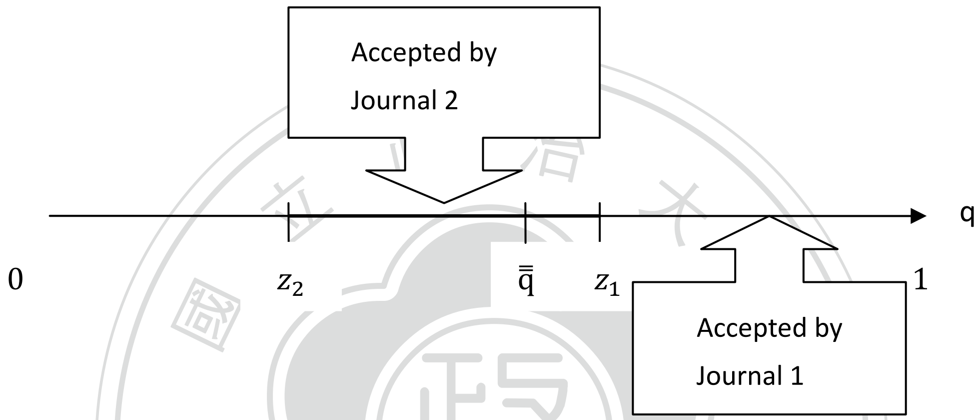

Figure3.3. the papers selected by each journal (3.b)

In this case, the papers with $q \in [z_1, 1]$ would be accepted and published by Journal 1 while those with $q \in [\bar{\bar{q}}, z_1]$ would be rejected and resubmitted to Journal 2. The papers sole-submitted to Journal 2 first with $q \in [z_1, z_2]$ would be accepted by Journal 2. While the papers with quality lower than z_2 will be rejected and resubmitted to Journal 1. The total quantity of papers Journal 1 reviewed is $(1 - \bar{\bar{q}})$ plus the resubmitted volume z_2 and costs him $c(1 - \bar{\bar{q}} + z_2)$ to referee. The load of Journal 2 is similar to the former case and costs her cz_1 to referee. The expected payoffs of both journals would be:

(3-13) $$\pi_{ss}^{1}|_{z_2<\bar{\bar{q}}<z_1} = \frac{\beta}{2}(1 - z_1^2) - c(1 - \bar{\bar{q}} + z_2)$$

(3-14) $$\pi_{ss}^{2}|_{\bar{\bar{q}}\le z_1} = \frac{\beta}{2}(z_1^2 - z_2^2) - cz_1$$

Case (3.c) $z_2 < z_1 < \bar{\bar{q}}$

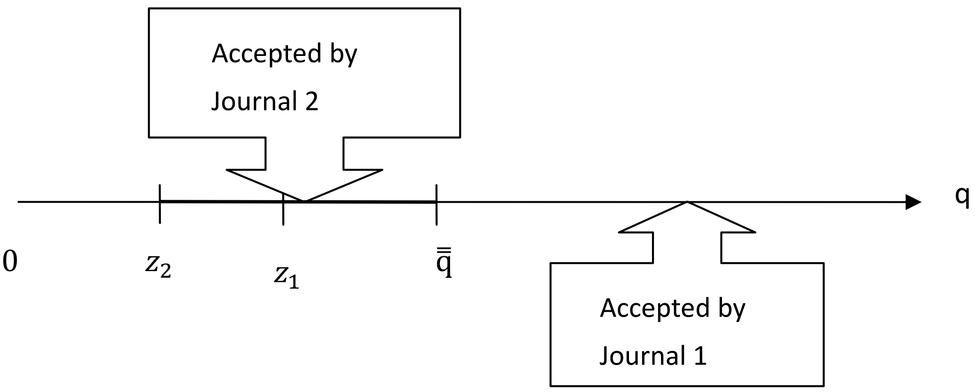

Figure3.4. the papers selected by each journal (3.c)

Things change if $\bar{\bar{q}} > z_1$. Since the Journal 1 is no longer the first screener of all the qualified papers since some of them are submitted first to Journal 2. The ones with $q \in [0, \bar{\bar{q}})$ will be screened initially by "Journal 2" in this case. And the papers with $q \in [z_2, \bar{\bar{q}})$ would be accepted by Journal 2. This makes the Journal 1 can collect the papers with writing ability between $\bar{\bar{q}}$ and 1 only. It costs Journal 1 $c(1 - \bar{\bar{q}} + z_2)$ and Journal 2 $c\bar{\bar{q}}$ to referee the papers. Therefore, the expected payoffs of both journals become the following,

(3-15) $$\pi_{ss}^1|_{z_2<z_1<\bar{\bar{q}}} = \frac{\beta}{2}(1 - \bar{\bar{q}}^2) - c(1 - \bar{\bar{q}} + z_2)$$

(3-16) $$\pi_{ss}^2|_{z_2<z_1<\bar{\bar{q}}} = \frac{\beta}{2}(\bar{\bar{q}}^2 - z_2^2) - c\bar{\bar{q}}$$

(ii) Multi-submission (MS)

The Multi-submission rule will be formed if both journals agree with the multiple-submissions. We have learned that the multiple-submitting would be the best response for all the authors. That means the Journal 1 again will be the first screener to all the papers. The expected payoffs are similar to the multi-submission case in the Chapter 2,

(3-17) $$\pi_{ms}^1 = \frac{\beta}{2}(1 - z_1^2) - c$$

(3-18) $$\pi_{ms}^2 = \frac{\beta}{2}(z_1^2 - z_2^2) - c$$

Given the payoffs of both journals under both submission rules, we can construct the expected payoffs tables of the strategy combination of following possible cases:

(i) $\bar{\bar{q}} < z_2 < z_1$

Strategy	S	M
S	$\begin{pmatrix} \frac{\beta}{2}(1 - z_1^2) - c, \\ \frac{\beta}{2}(z_1^2 - z_2^2) - cz_1 \end{pmatrix}$	$\begin{pmatrix} \frac{\beta}{2}(1 - z_1^2) - c, \\ \frac{\beta}{2}(z_1^2 - z_2^2) - cz_1 \end{pmatrix}$
M	$\begin{pmatrix} \frac{\beta}{2}(1 - z_1^2) - c, \\ \frac{\beta}{2}(z_1^2 - z_2^2) - cz_1 \end{pmatrix}$	$\begin{pmatrix} \frac{\beta}{2}(1 - z_1^2) - c, \\ \frac{\beta}{2}(z_1^2 - z_2^2) - c \end{pmatrix}$

Table 3.1. The expected payoffs matrix of the strategy combination (i)

We can show the following results after comparing the expected payoffs.

$$\pi_{ss}^1|_{\bar{\bar{q}}<z_2<z_1} = \frac{\beta}{2}(1 - z_1^2) - c = \pi_{ms}^1$$

$$\pi_{ss}^2|_{\bar{\bar{q}}\le z_1} = \frac{\beta}{2}(z_1^2 - z_2^2) - cz_1 > \frac{\beta}{2}(z_1^2 - z_2^2) - c = \pi_{ms}^2$$

Given any strategy of Journal 2, Journal 1 is indifferent under both submission rules. On the other hand, given any strategy of Journal 1, Journal 2 would also not to agree with multi-submission rule for the increased reviewing load. The pure strategy Nash equilibrium would be **(s, s) (m, s)** which leads to sloe-submission rule.

(ii) $z_2 < \bar{\bar{q}} < z_1$

Strategy	S	M
S	$\begin{pmatrix} \frac{\beta}{2}(1 - z_1^2) - c(1 - \bar{\bar{q}} + z_2), \\ \frac{\beta}{2}(z_1^2 - z_2^2) - cz_1 \end{pmatrix}$	$\begin{pmatrix} \frac{\beta}{2}(1 - z_1^2) - c(1 - \bar{\bar{q}} + z_2), \\ \frac{\beta}{2}(z_1^2 - z_2^2) - cz_1 \end{pmatrix}$
M	$\begin{pmatrix} \frac{\beta}{2}(1 - z_1^2) - c(1 - \bar{\bar{q}} + z_2), \\ \frac{\beta}{2}(z_1^2 - z_2^2) - cz_1 \end{pmatrix}$	$\begin{pmatrix} \frac{\beta}{2}(1 - z_1^2) - c, \\ \frac{\beta}{2}(z_1^2 - z_2^2) - c \end{pmatrix}$

Table3.2. the expected payoffs matrix of the strategy combination (ii)

We have,

$$\pi^1_{ss}|_{z_2<\bar{\bar{q}}<z_1} = \frac{\beta}{2}(1-z_1^2) - c(1-\bar{\bar{q}}+z_2) > \frac{\beta}{2}(1-z_1^2) - c = \pi^1_{ms}$$

$$\pi^2_{ss}|_{\bar{\bar{q}}\le z_1} = \frac{\beta}{2}(z_1^2 - z_2^2) - cz_1 > \frac{\beta}{2}(z_1^2 - z_2^2) - c = \pi^2_{ms}$$

Given any submission policy of the another journal, both Journal 1 and Journal 2 will not agree with the multiple-submission rule since it generates *extra* cost for both journals but doesn't change their gains. Then we have the pure strategy Nash equilibrium **(s, s)** which determines the sole-submission as the equilibrium submission rule.

(iii) $z_2 < z_1 < \bar{\bar{q}}$

Strategy	S	M
S	$\begin{pmatrix}\frac{\beta}{2}(1-\bar{\bar{q}}^2) - c(1-\bar{\bar{q}}), \\ \frac{\beta}{2}(\bar{\bar{q}}^2 - z_2^2) - c\bar{\bar{q}}\end{pmatrix}$	$\begin{pmatrix}\frac{\beta}{2}(1-\bar{\bar{q}}^2) - c(1-\bar{\bar{q}}), \\ \frac{\beta}{2}(\bar{\bar{q}}^2 - z_2^2) - c\bar{\bar{q}}\end{pmatrix}$
M	$\begin{pmatrix}\frac{\beta}{2}(1-\bar{\bar{q}}^2) - c(1-\bar{\bar{q}}), \\ \frac{\beta}{2}(\bar{\bar{q}}^2 - z_2^2) - c\bar{\bar{q}}\end{pmatrix}$	$\begin{pmatrix}\frac{\beta}{2}(1-z_1^2) - c, \\ \frac{\beta}{2}(z_1^2 - z_2^2) - c\end{pmatrix}$

Table3.3. the expected payoffs matrix of the strategy combination (iii)

Again, we can have the following results after comparing the expected payoffs.

$$\pi^1_{ss}|_{\bar{\bar{q}}>z_1} = \frac{\beta}{2}(1-\bar{\bar{q}}^2) - c(1-\bar{\bar{q}}) \gtreqless \frac{\beta}{2}(1-z_1^2) - c = \pi^1_{ms} \;\text{ if }\; c(\bar{\bar{q}} - z_2) \gtreqless \frac{\beta}{2}(\bar{\bar{q}} - z_1^2)$$

$$\pi^2_{ss}|_{\bar{\bar{q}}\le z_1} = \frac{\beta}{2}(\bar{\bar{q}}^2 - z_2^2) - c\bar{\bar{q}} > \frac{\beta}{2}(z_1^2 - z_2^2) - c = \pi^2_{ms}$$

For analytical convenience, we focus on publisher 2 first. Given any strategy of Journal 1, Journal 2 would not deviate from sole-submission since the multi-submission not only costs him more in reviewing the papers but also brings in less qualified papers to be published in their journal. On the other hand, for publisher 1, once multi-submission rule is formed, Journal 1 gains more qualified papers but also expends with higher cost to review more submitted papers. Journal 1 would prefer the multiple-submission rule only if the relative increasing reviewing cost is low enough. Since Journal 2 would not deviate from the sole-submission rule, both (s,

s) and (m, s) strategy combinations will determine the equilibrium submission rule as sole-submission.

Proposition 7.

When authors have a constant time-preference on the utility and the publishers referee the submissions with a similar speed, equilibrium submission rule of the industry is sole-submission.

With the results above, it is clear that under sole-submission rule Journal 2 has chance to screen a specific volume of papers $[0, \bar{\bar{q}}]$. And under certain situation she can collect higher quality papers which are certified by both journals which we have shown in case (3.c). This makes Journal 2 not to deviate from sole-submission policy.

3.2. Welfare Analysis

In this section, we again apply the aggregate method to estimate the welfare of the industry. Given the reactions of authors under both submission rules, we can have the aggregate expected values as follows:

Authors' Welfare

$$E[U]^{ss} = \int_0^{\bar{\bar{q}}} V(J_2, J_1)\, dq + \int_{\bar{\bar{q}}}^1 V(J_1, J_2)\, dq$$

$$= \int_0^{\bar{\bar{q}}} P_2R_2 + \delta(1 - P_2)P_1R_1\, dq + \int_{\bar{\bar{q}}}^1 P_1R_1 + \delta(1 - P_1)P_2R_2\, dq$$

$$E[U]^{ms} = \int_0^1 V(J_1 \& J_2)\, dq$$

$$= \int_0^{\bar{\bar{q}}} P_1R_1 + (1 - P_1)P_2R_2\, dq + \int_{\bar{\bar{q}}}^1 P_1R_1 + (1 - P_1)P_2R_2\, dq$$

Since multiple-submission is the dominant strategy for all authors, we have

$$V(J_1 \& J_2) > V(J_2, J_1) > V(J_1, J_2) \text{ if } q \le \bar{\bar{q}}$$
$$V(J_1 \& J_2) > V(J_1, J_2) > V(J_2, J_1) \text{ if } q > \bar{\bar{q}}$$

Then we can conclude that

$$E[U]^{ss} < E[U]^{ms}$$

For authors, they always prefer the multiple-submission rather than sole-submission rule.

Publishers' Welfare

On the other hand, we should discuss two possible situations of the publishers' side:

(i) $\bar{\bar{q}} < z_2 < z_1$

$$E[\pi]^{ss}_{\bar{\bar{q}}<z_2<z_1} = \pi^1_{ss}|_{\bar{\bar{q}}<z_2<z_1} + \pi^2_{ss}|_{\bar{\bar{q}}<z_2<z_1} = \frac{\beta}{2}(1 - z_2^2) - c(1 + z_1)$$

$$E[\pi]^{ms} = \pi^1_{ms} + \pi^2_{ms} = \frac{\beta}{2}(1 - z_2^2) - 2c$$

Since z_1 is less than one, we have,

$$E[\pi]^{ss}_{\bar{\bar{q}}<z_2<z_1} > E[\pi]^{ms}$$

(ii) $z_2 < \bar{\bar{q}} < z_1$

$$E[\pi]^{ss}_{z_2<\bar{\bar{q}}<z_1} = \pi^1_{ss}|_{z_2<\bar{\bar{q}}<z_1} + \pi^2_{ss}|_{z_2<\bar{\bar{q}}<z_1} = \frac{\beta}{2}(1 - z_2^2) - c(1 + z_1 + z_2 - \bar{\bar{q}})$$

$$E[\pi]^{ms} = \frac{\beta}{2}(1 - z_2^2) - 2c$$

With the fact that $(1 + z_1 + z_2 - \bar{\bar{q}})$ is less than 2 given the position of $\bar{\bar{q}}$ respect to z_1 and z_2, we have the following result.

$$E[\pi]^{ss}_{z_2<\bar{\bar{q}}<z_1} > E[\pi]^{ms}$$

(iii) $z_2 < z_1 < \bar{\bar{q}}$

$$E[\pi]^{ss}_{z_2<z_1<\bar{\bar{q}}} = \pi^1_{ss}|_{z_2<z_1<\bar{\bar{q}}} + \pi^2_{ss}|_{z_2<z_1<\bar{\bar{q}}} = \frac{\beta}{2}(1 - z_2^2) - c(1 + z_2)$$

$$E[\pi]^{ms} = \frac{\beta}{2}(1 - z_2^2) - 2c$$

Since z_2 is less than one, we have,

$$E[\pi]^{ss}_{z_2<z_1<\bar{\bar{q}}} > E[\pi]^{ms}$$

With the results above, sole-submission rule generates the same publication value as the multiple-submission rule but always with lower over-all reviewing cost for publishers in the academic industry.

Social Welfare

With the aggregate utilities of both populations in this industry, we can calculate the over-all welfare of each submission rule as follows.

(a) $\bar{\bar{q}} < z_2 < z_1$

$$E[W]^{ss}_{\bar{\bar{q}}<z_2<z_1} = E[U]^{ss} + E[\pi]^{ss}_{\bar{\bar{q}}<z_2<z_1}$$

$$= \int_0^{\bar{\bar{q}}} P_2R_2 + \delta(1-P_2)P_1R_1\,dq + \int_{\bar{\bar{q}}}^1 P_1R_1 + \delta(1-P_1)P_2R_2\,dq + \frac{\beta}{2}(1-z_2^2) - c(1+z_1)$$

$$E[W]^{ms}_{\bar{\bar{q}}<z_2<z_1} = E[U]^{ms} + E[\pi]^{ms}$$

$$= \int_0^{\bar{\bar{q}}} P_1R_1 + (1-P_1)P_2R_2\,dq + \int_{\bar{\bar{q}}}^1 P_1R_1 + (1-P_1)P_2R_2\,dq + \frac{\beta}{2}(1-z_2^2) - 2c$$

The multiple-submission is social-desirable if the following condition holds.

$$E[W]^{ms}_{\bar{\bar{q}}<z_2<z_1} > E[W]^{ss}_{\bar{\bar{q}}<z_2<z_1}$$

(3-19) $$E[U]^{ms} - E[U]^{ss} > c(1-z_1)$$

(b) $z_2 < \bar{\bar{q}} < z_1$

$$E[W]^{ss}_{z_2<\bar{\bar{q}}<z_1} = E[U]^{ss} + E[\pi]^{ss}_{z_2<\bar{\bar{q}}<z_1}$$

$$= \int_0^{\bar{\bar{q}}} P_2R_2 + \delta(1-P_2)P_1R_1\,dq + \int_{\bar{\bar{q}}}^1 P_1R_1 + \delta(1-P_1)P_2R_2\,dq + \frac{\beta}{2}(1-z_2^2) - c(1+z_1+z_2-\bar{\bar{q}})$$

$$E[W]^{ms}_{z_2<\bar{\bar{q}}<z_1} = E[U]^{ms} + E[\pi]^{ms}$$

$$= \int_0^{\bar{\bar{q}}} P_1R_1 + (1-P_1)P_2R_2\,dq + \int_{\bar{\bar{q}}}^1 P_1R_1 + (1-P_1)P_2R_2\,dq + \frac{\beta}{2}(1-z_2^2) - 2c$$

The multiple-submission is social-desirable if the following condition holds.

$$\mathrm{E[W]}^{\mathrm{ms}}_{z_2<\bar{\bar{q}}<z_1} > E[W]^{\mathrm{ss}}_{z_2<\bar{\bar{q}}<z_1}$$

(3-20)
$$\mathrm{E[U]^{ms} - E[U]^{ss}} > c(1 - \mathrm{z}_1 + \bar{\bar{\mathrm{q}}} - \mathrm{z}_2)$$

(c) $z_2 < z_1 < \bar{\bar{\mathrm{q}}}$

$$\mathrm{E[W]}^{\mathrm{ss}}_{z_2<z_1<\bar{\bar{q}}} = \mathrm{E[U]^{ss}} + \mathrm{E[\pi]}^{\mathrm{ss}}_{z_2<z_1<\bar{\bar{q}}}$$

$$= \int_0^{\bar{\bar{q}}} \mathrm{P_2R_2} + \delta(1-\mathrm{P_2})\mathrm{P_1R_1}\,\mathrm{dq} + \int_{\bar{\bar{q}}}^1 \mathrm{P_1R_1} + \delta(1-\mathrm{P_1})\mathrm{P_2R_2}\,\mathrm{dq} + \frac{\beta}{2}(1-\mathrm{z}_2^2) - \mathrm{c}(1+\mathrm{z}_2)$$

$$\mathrm{E[W]}^{\mathrm{ms}}_{z_2<z_1<\bar{\bar{q}}} = \mathrm{E[U]^{ms}} + \mathrm{E[\pi]^{ms}}$$

$$= \int_0^{\bar{\bar{q}}} \mathrm{P_1R_1} + (1-\mathrm{P_1})\mathrm{P_2R_2}\,\mathrm{dq} + \int_{\bar{\bar{q}}}^1 \mathrm{P_1R_1} + (1-\mathrm{P_1})\mathrm{P_2R_2}\,\mathrm{dq} += \frac{\beta}{2}(1-\mathrm{z}_2^2) - 2\mathrm{c}$$

The multiple-submission is social-desirable if the following condition holds.

$$\mathrm{E[W]}^{\mathrm{ms}}_{z_2<z_1<\bar{\bar{q}}} > E[W]^{\mathrm{ss}}_{z_2<z_1<\bar{\bar{q}}}$$

(3-21)
$$\mathrm{E[U]^{ms} - E[U]^{ss}} > c(1 - \mathrm{z}_2)$$

Proposition 8. Conflicting interests between authors and publishers

Given authors has a constant time-preference on the utility and the journals referee papers with a similar speed, Sole-Submission rule would be welfare-superior than multiple-submission rule if the increase in reviewing cost due to submission rule change (from sole-submission to multiple-submission) is higher than the enhanced utility of authors in the multiple-submission rule.

We can show this result with equations (3-19), (3-20) and (3-21). In case (a) where $\bar{\bar{\mathrm{q}}} < z_2 < z_1$, the multiple-submission would be welfare superior only if the enhanced welfare of authors under the multiple-rule is higher than $c(1 - \mathrm{z}_1)$ which is the raised extra reviewing burden of the adoption of multiple-submission. The following two cases may lead to the similar conclusion. Thereby, if the enhanced welfare of *time-saving* of authors under multiple-submission rule is higher than the increase in reviewing cost due to submission rule change, multiple-submission would be the social-desirable choice. Since the utility is not transferable in the model, the publishers should absorb the increased reviewing cost under multiple-submission rule. It tells that even though the multiple-submission rule is social-desirable, it would not be the equilibrium submission rule which we have shown in Proposition 7.

Moreover, we can show that if the authors have a higher time preference the multiple-submission will be more likely the social-desirable result with the following discussion. We have known the enhance welfare of authors under multiple-submission rule is as follows,

$$E[U]^{ms} - E[U]^{ss}$$

It equals to

(3-22) $$\int_0^{\bar{\bar{q}}}(1-\delta)P_1R_1 + P_1P_2(\delta R_1 - R_2)\,dq + \int_{\bar{\bar{q}}}^1(1-\delta)(1-P_1)P_2R_2\,dq$$

Then we take partial derivative of the equation above and get

(3-23) $$\frac{\partial E[U]^{ms} - E[U]^{ss}}{\partial\delta} = -\int_0^{\bar{\bar{q}}} P_1R_1 - \delta P_1P_2R_1\,dq - \int_{\bar{\bar{q}}}^1 \delta(1-P_1)P_2R_2\,dq < 0$$

With equation (3-23), we can see that more impenitent are the authors (lowerδ) the higher is the enhanced welfare when applying the multiple-submission. It implies that we “should” change current submission convention to multiple-rule if the time-saving effect is significant. As Ng (1991) notes, one possible reason of the submission convention rigidity of the academic industry must be the underestimate of the delaying effect of authors.