

# Analyses of Ratcheting Effect in Performance Evaluation of Library

Xin Zhang

Library of Jimei University, 185 Yinjiang Rd., Jimei District, Xiamen, China

zxxm@jmu.edu.cn

**Keywords:** Theory of principal-agent, Ratcheting effect, Performance assessing

**Abstract:** In the daily work of library, there is principal-agent relationship between manager and librarians. By applying the principal-agent theory, we create a two stages ratcheting model, and analyse ratcheting phenomenon in performance evaluation of library. This model shows that, by means of strengthen the communication between librarians and managers, emphasizing the whole interests of libraries and introducing relative performance comparison, ratcheting effect can be weakened to some extent.

## 1. Introduction

At present, the salary models implemented by many libraries, especially university libraries, consist of fixed wages, performance-based wages and subsidies, build connection between the librarians' salaries and their most quantifiable performances, and integrate incentives into the overall objectives of the library. However, in the process of designing salary incentive mechanism, it is a very difficult problem how to evaluate the performance of librarians. Library managers always hope the evaluation criteria to be as objective as possible, because the more objective the criteria, the more accurate the evaluation of the librarian's work, and the more effective the incentive.

Usually, the manager uses the past performance of the librarian as the benchmark, and bases on it to develop a new work plan. However, the quality of the librarians is uneven, and the level of effort is not the same. Therefore, the completed workload within a certain period of time is different. For this reason, there may be a phenomenon that librarians with high professional quality and hard-working fulfil the tasks ahead of time, while librarians with low professional quality and lazy-working fail to complete the tasks on time.

In this case, Library managers may think that the former has less workload and needs to raise, while the latter has a large workload and needs to cut down. Therefore, librarians with high professional quality and hard-working will no longer continue to work hard, because they predict that the harder they work, the higher their performance standards will be. As a result, their working enthusiasm declined.

The irreversibility of the trend of this performance standard rising with performance is known as the Ratcheting Effect. Because of the Ratchet Effect, good performance is punished (with higher workload), which weakens the incentive effect.<sup>[1]</sup>

This paper develop a ratcheting effect model about a library performance management, by means of analysing this model, we answer the reasons why the ratcheting effect rise and its consequence. Finally, we put forward some measures to reduce the ratcheting effect.

## 2. Establishment and Analysis of Ratcheting Effect Model

### 2.1. Overview of Ratcheting Effect

The term of Ratchet Effect originated from the study of the Soviet-style planned economy system. In the principal-agent relationship, the principal tries to establish evaluation criteria based on the past performance of the agent. However, the harder the agent works, the greater the possibility of good performance and the higher the criteria. When an agent predicts that his efforts

will improve the "standard", his enthusiasm for efforts will decline. The trend of this standard rising with the performance of agents is called Ratcheting Effect<sup>[2]</sup>, which is also called as "whipping the fast cattle" in China.<sup>[3]</sup>

Ratchet Effect mode has been applied to a lot of fields with the diffusion of norms. Such as, Bertels & Pelozo (2008) develop a model to explain the diffusion of corporate social responsibility (CSR) norms, they argue results in slowly ratcheting expectations over time.<sup>[4]</sup> Carbonell (2012) argue for the existence of a 'ratcheting - up effect', the behaviour of moral saints serves to increase the level of moral obligation the rest of us face.<sup>[5]</sup>

Target setting is at the core of the planning processes in organizations. Targets define an expected level of performance and converge into planning documents. Performance evaluation are organizational activities intimately associated with planning and target setting. Managers use a diverse set of information sources to set targets and weight these different sources depending on a lot of factors. There are two sources of information, past performance and the performance of comparable responsibility centres.<sup>[6]</sup>

Past performance may provide relevant information to set targets if variances (actual versus expected performance) are associated with permanent changes in performance. This is consistent with performance being correlated over time and changes in performance having a permanent component associated with future performance. Theoretical work (Alison et al. 1991)<sup>[7]</sup> as well as empirical evidence (Leone and Rock 2002)<sup>[8]</sup> suggests that past performance may be optimally used to set targets.

If variances reflect permanent changes in performance, the expectations about future performance will incorporate the magnitude of these variances leading to ratcheting. That is, the ratcheting effect reflects happens when favourable variances lead to an increase in future targets compared to past performance.<sup>[9]</sup>

In the library, the managers as the principal, entrusts the librarian with the task of completing the work and realizing the overall goal of the library, to a certain extent, librarians are entrusted by managers. For this reason, librarians are the agents to realize the overall objectives of the library. Therefore, the relationship between librarians and managers constitutes the actual principal-agent relationship.<sup>[10]</sup>

Managers will set up targets for every departments and assign task to individuals. By means of evaluating the performance of each librarians and allocate their salary according to. If the salary incentive scheme of a library is not properly designed, ratcheting effect may occur.

## 2.2. Hypothesis of the Ratcheting Effect model

**Hypothesis 1:** Assuming that the principal-agent relationship between librarians and managers only lasts for two periods,  $t=1, 2$ , the workload (i.e. output) accomplished by librarians in each period is:

$$\pi_t = \alpha_t + \theta + \mu_t \quad t=1, 2 \quad (1)$$

In the above formula,  $\pi_t$  is the workload (i.e. output) accomplished by librarians in period  $t$ ,  $\alpha_t$  is the level of librarians' effort,  $\theta$  is the actual working ability of librarians (assuming that it is independent of time), and  $\mu_t$  is an exogenous random variable (e.g. the uncertainty from the relevant policies of libraries, the changes of readers' preferences and readers' needs, etc.).

It is assumed that  $\alpha_t$  is the private information of librarians,  $\pi_t$  is common information, the distribution of  $\theta$  is normal, and its mean value is  $E(\theta) = \bar{\theta} > 0$ , its variance is  $\sigma_\theta^2$ ;  $\mu_t$  is normal distribution, its mean value is 0, variance is  $\sigma_\mu^2$ ; furthermore, it is assumed that the random variables  $\mu_1$  and  $\mu_2$  are independent, i.e.  $cov(\mu_1, \mu_2)=0$ .

**Hypothesis 2:** Assuming that librarians are risk-neutral and the discount rate is 1, their utility function is:

$$U = \omega_1 - c(\alpha_1) + \omega_2 - c(\alpha_2) \quad (2)$$

In the above formula,  $\omega_t$  is the earnings that librarians get through their work in the period t,  $c(\alpha_t)$  is the cost of their efforts (i.e., the negative utility brought with by their efforts).

**Hypothesis 3:** Assume that the librarian has certain rational anticipation ability, and in equilibrium, the librarian's effort is:

$$E(\alpha_t) = \bar{\alpha} \quad (3)$$

### 3. Analysis of the Ratcheting Effect

Hypothesis 3 shows that the actual effort level of librarians is  $\bar{\alpha}$  in equilibrium. However, when the managers observe the workload (i.e. output) completed by the librarian in period 1, the managers know  $\theta + \mu_1 = \pi_1 - \bar{\alpha}_1$ , but they cannot distinguish between  $\theta$  and  $\mu_1$ .

That is, except the librarian's efforts, the managers do not know that  $\pi_1$  is determined by the librarian's real ability  $\theta$  or by the exogenous uncertainties  $\mu_1$ . The managers should infer the librarian's actual working ability  $\theta$  according to  $\pi_1$ . Let,

$$\tau = \frac{\sigma_\theta^2}{\sigma_\theta^2 + \sigma_\mu^2} \quad (4)$$

That is,  $\tau$  the ratio of variance of  $\theta$  to variance of  $\pi_1$ . The bigger  $\sigma_\theta^2$  is, the bigger  $\tau$  is, according to the rational expectation formula and  $E\theta = \bar{\theta} > 0$ , we can get:

$$E(\theta|\pi_1) = (1 - \tau)\bar{\theta} + \tau(\pi_1 - \bar{\alpha}_1) \quad (5)$$

The managers set the fixed workload of the Librarians as  $\lambda_t$  in each period, then the librarians gain  $\omega_t = \pi_t - \lambda_t$ , through their work in period t. Here,  $\omega_t$  does not mean that librarians have residual claim rights. It only means that, if  $\omega_t > 0$ , they are rewarded (or not punished) by managers, they will be rewarded by librarians. If  $\omega_t < 0$ , they will be criticized (or punished) by managers.

Let  $\lambda_t$  as the expected working ability of librarians, we can get:

$$\lambda_1 = E(\theta) = \bar{\theta} \quad (6)$$

$$\lambda_2 = E(\theta|\pi_1) = (1 - \tau)\bar{\theta} + \tau(\pi_1 - \bar{\alpha}_1) \quad (7)$$

By substituting  $\lambda_1$  and  $\lambda_2$  into the utility function of formula (2), the following results can be obtained:

$$\begin{aligned} U &= \pi_1 - \lambda_1 - c(\alpha_1) + \pi_2 - \lambda_2 - c(\alpha_2) \\ &= [(1 - \tau)\alpha_1 + (1 - \tau)\theta + (1 - \tau)\mu_1 - c(\alpha_1)] \\ &\quad + (\alpha_2 + \theta + \mu_2 - c(\alpha_2)) - (2 - \tau)\bar{\theta} + \tau\bar{\alpha}_1 \end{aligned} \quad (8)$$

By optimizing the above utility function, the first-order condition can be obtained:

$$\frac{\partial U}{\partial \alpha_1} = 0 \Rightarrow c'(\alpha_1) = 1 - \tau < 1 \quad (9)$$

$$\frac{\partial U}{\partial \alpha_2} = 0 \Rightarrow c'(\alpha_2) = 1 \quad (10)$$

Formula (9) and (10) shows that the librarian's effort level in period 2 is optimal, but in period 1, adding one unit  $\tau\alpha_1$  (effort level) will raise  $\tau$  unit of the expectation of librarian's working ability (that is,  $\tau\alpha_1$ ), so that the managers will set more  $\tau\alpha_1$  fixed workload for the librarian in period 2 than in period 1. Therefore, the marginal benefit of  $\tau\alpha_1$  is  $1 - \tau < 1$ , it weakens the incentive effect and leads to the ratcheting effect. Moreover, the greater the uncertainty of librarians' working ability, the greater the incentive loss.

## 4. Conclusions and Suggestions

From the previous analysis, we can see that the ratchet effect often has a negative impact on library management, it reduces the performance and enthusiasm of librarians, and even affects the cultural construction and long-term development of libraries. Therefore, by improving the library incentive and restraint mechanism, the ratchet effect can be weakened to a certain extent.

### 4.1. Strengthen the communication between librarians and managers -- reduce $\sigma_0$ , thereby reducing $\tau$

Strengthening the communication between library managers and librarians and enhance their mutual understanding and trust is an important way to overcome the information asymmetry between them. If managers lack the relevant information of librarians, it will be difficult for managers to objectively evaluate the performance of librarians.

Therefore, in the actual work of the library, the managers should consciously take some time to communicate with the librarians and understand the problems they encounter in their work.

On the other hand, the librarians should keep a good record of their work logs and record the problems they encounter in detail so as to submit them to the managers. So that they can clearly understand each step of their work.

### 4.2. Emphasizing the whole interests of Libraries

In real life, quite a number of librarians also have great professional ethics. They put the whole interests of library in the first place. Even though they know that hard work will lead to the improvement of performance evaluation standards, they will still work hard as long as it is beneficial to the whole interests of a library.<sup>[11]</sup>

Therefore, library managers should pay attention to cultivating the teamwork consciousness of librarians, and establish the thinking that the whole interests are put in a prior position. If all librarians have good professional ethics and every librarian consciously works hard, obviously, "ratchet effect" will not exist.

### 4.3. Introducing relative performance comparison

According to the proof of Mayer and Vickers (1994),<sup>[12]</sup> when the correlation between internal productivity is greater than that of exogenous random variables, the introduction of relative performance comparison will reduce the weight of performance in the first stage when inferring "internal productivity", thereby weakening the "ratcheting effect".

Target setting is often highly subjective and thus might adapt faster to changes in the information environment. So, relative performance has often been discussed within the context of performance evaluation (Antle and Smith 1986)<sup>[13]</sup> as a potentially effective approach to reduce the impact of measurement noise on the evaluation and incentive provision of managers (Holmstrom 1982).<sup>[14]</sup>

The performance of comparable responsibility units has information relevant to assess individual performance because of factors correlated across individuals. These factors are assumed to be uncorrelated with managers' characteristics. This argument can be extended to target setting where the performance of comparable responsibility units may have information relevant to set the targets of a particular individual.

Therefore, librarians can introduce "relative performance comparison", using the performance of other peer librarians, the establishment of performance evaluation standards for Librarians in our library depends not only on the performance of our library, but also on the performance of Librarians in other peer libraries. By comparing the performance of librarians, it reflects their respective efforts to a certain extent, and provides the basis for formulating the corresponding performance evaluation standards.

## References

[1] Jiang Yuan, Wanhua, (2007) Research on Motivation and Restraint Mechanism of Managers of

State-owned Enterprises Based on Ratchet Effect. *Social Sciences Vertical and Transverse*, 6, 106-107. (In Chinese).

[2] Chen Sanyan, Yuan Leping, (2008) The ratcheting effect in performance appraisal based on game theory," *Journal of Changjiang University (Social Science Edition)*. 12, 84-86. (In Chinese).

[3] <http://www.jdzj.com/gongcheng/article/2006-7-27/2930-1.htm>, Ratcheting effect in project management. 2010-5-20 (In Chinese).

[4] Bertels, S. & Peloza, (2008) Running Just to Stand Still? Managing CSR Reputation in an Era of Ratcheting Expectations. *J. Corp Reputation Rev*, 11: 56-72

[5] Carbonell V. (2012) The ratcheting - up effect. *Pacific Philosophical Quarterly*, 93(2): 228-254.

[6] Matsumura, E. M., and J. Y. Shin. (2006) An empirical analysis of an incentive plan with relative performance measures: Evidence from a postal service. *The Accounting Review*, 81 (3), 533-566.

[7] Alison, K., S. Reichelstein, and P. K. Sen. (1991) Participation, slack, and budget-based performance evaluation. *Journal of Accounting Research*, 29 (1):109-128.

[8] Leone, A. J., and S. Rock. (2002) Empirical tests of budget ratcheting and its effect on managers' discretionary accrual choices. *Journal of Accounting and Economics*, 33 (1), 43-67.

[9] Aranda C, Arellano J, Davila A. (2010) Ratcheting effect and the role of relative target setting. Working paper.

[10] Gao Hongyang, Zhang Xia, (2009) Application of Asymmetric Information Economics in Library Science Research in China. *Journal of Chinese Library Science*. 3, 106-110. (In Chinese).

[11] Zhang Xin, (2008) The Core Value of Achievement Management in University Libraries," *Library Construction*.5, 96-98. (In Chinese).

[12] Meyer, M. and J. Vickers, (1994) Performance Comparison and Dynamic Incentive. Mimeo, Nuffield College, Oxford University.

[13] Antle, R., and A. Smith. (1986) An empirical investigation of the relative performance evaluation of corporate executives. *Journal of Accounting Research*, 24 (1), 1-39.

[14] Holmstrom, B. (1982) Moral hazard in teams. *Bell Journal of Economics*, 13,324-340.

[15] Zhang Weiyong, (2004) *Game Theory and Information Economics*. Shanghai: Gezhi Publishing House. (In Chinese)