Comparative Industrial Systems

Quantity targets: static analysis

The Ames model and the Soviet 1965 reform model (as interpreted by Bonin and Ireland and Law) control the output level only indirectly, through incentives. In reality, a centrally planned economy may find it necessary **to target output directly** because of the necessity of planning. Some outputs are strategic outputs, because they are inputs to most other outputs, or because they are very important to people's livelihood. It may then be necessary to maximize their output level, particularly in a developing socialist country. That is why CPEs are traditionally depicted as "output maximizers". It appears that economic reforms have not eliminated such needs in many cases.

Now to motivate enterprises to maximize output might be easier shortly after the revolution when moral suasion could often work as people's morale was often very high. A charismatic leader like Mao would certainly help. Eventually, however, as revolutionary zeal dies down, managers and workers may not continue to put forth their best efforts, and X-inefficiency would arise. Planned targets are often under-fulfilled. Moreover, CPEs may find it beneficial for themselves to with hold information from the central planners, e.g. to understate their productive capacities, so that the planners may set them targets of outputs that are easy to fulfill. They will also tend to use inputs rather inefficiently.

Under such a situation, the planners may wish to set "taut" plans for the CPEs to eliminate X-inefficiency: authorized inputs are kept low, and targeted outputs are kept high. One simple way to impose "tautness" is simply to modify previous directives, e.g. to make a standard deduction from actual inputs previously used, and to make an addition to output actually produced. This is called the "From the Achieved Level" (FTAL) planning. To motivate CPEs, the planners of course have also to provide incentives. A bonus scheme on outputs is the obvious candidate.

Now, the problem is actually quite complicated because the objective of the planners is not just to maximize actual outputs, in which case a

simple bonus scheme will do, but to carry out planning that ensures maximum growth. So the best outcome for planners is maximum growth that confirms with their targets. Otherwise, slacks and shortages will co-exist and bottlenecks will constrain growth.

One bonus scheme that takes into account these problems and which has often been used is like this: the planners suggest a target output $\bar{q}$ to the enterprise and receive a feedback target $\hat{q}$ proposed by managers, which after negotiated may be adjusted and accepted. Planners then stipulate that if $\hat{q}$ is fulfilled exactly, managers will receive the bonus $\hat{B}$ where

$$\hat{B} = \bar{B} + \beta(\hat{q} - \bar{q}) \qquad \text{---------- (10)}$$

where $\bar{B}$ is the bonus for plan fulfillment, $\bar{q}$ is the initial target suggested by the planners and β is a parameter fixed as the "bonus coefficient". So $(\hat{q} - \bar{q})$ provides a motivation for the CPEs to raise their targets.

The planners also stipulate how the bonus will vary from $\hat{B}$ if $\hat{q}$ is under-fulfilled or over-fulfilled by actual output q:

$$B = \begin{cases} \hat{B} + \alpha(q - \hat{q}) & \text{if } q \geq \hat{q} \\ \hat{B} - \gamma(\hat{q} - q) & \text{if } q < \hat{q} \end{cases} \qquad \text{---------- (11)}$$

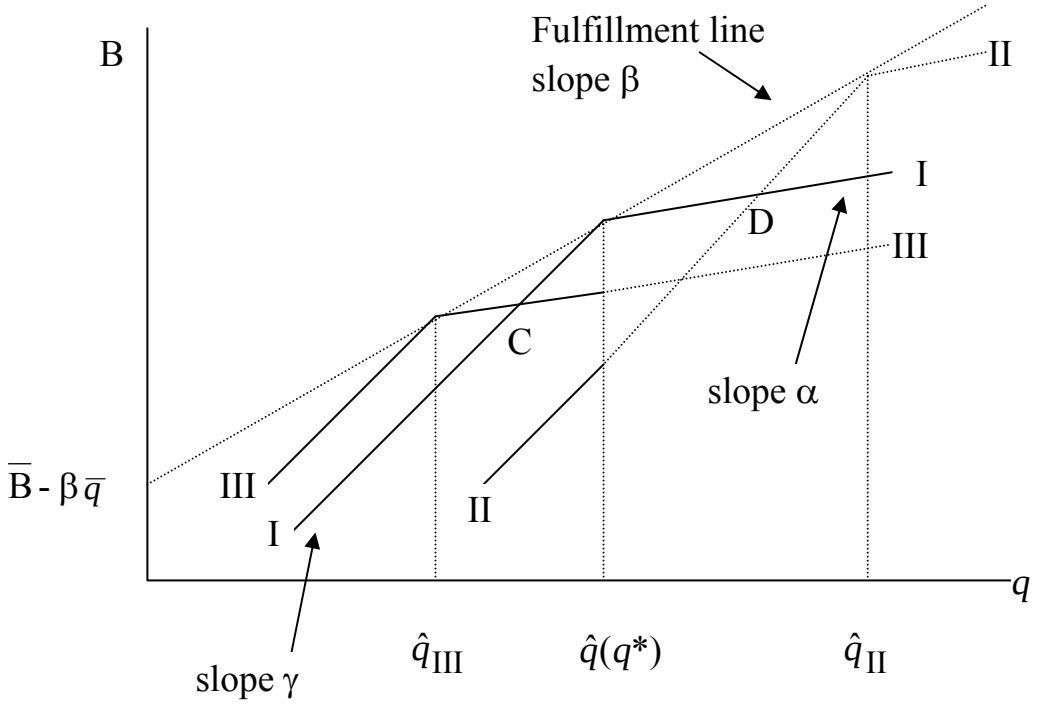
For the scheme to have the desired effect, the coefficients in (11) must be so fixed that

$$0 < \alpha < \beta < \gamma \qquad \text{---------- (12)}$$

[if not, what problems?]

Combining (10) and (11), we obtain

$$B = \begin{cases} \bar{B} + \beta(\hat{q} - \bar{q}) + \alpha(q - \hat{q}) & \text{if } q \geq \hat{q} \\ \bar{B} + \beta(\hat{q} - \bar{q}) + \gamma(q - \hat{q}) & \text{if } q < \hat{q} \end{cases} \qquad \text{---------- (13)}$$



I is defined by eq. (13). It is kinked because $\gamma > \beta$. We call I the "kinked bonus function".

Now, we can prove that if eq. (12), i.e. $0 < \alpha < \beta < \gamma$, is fulfilled, the enterprise will actually choose $\hat{q}$, which is equal to its maximum possible output level q^*.

The bonus scheme will ensure $\hat{q} = q^*$, even if q^* is known just to the CPE but not to the planners.

The reason is simple: the CPE's problem is to choose $\hat{q}$ and q to maximize B. However, since for a given $\hat{q}$, B increases with q (the I function is positively sloped despite the kink). So the CPE's problem is reduced to that of choosing $\hat{q}$ to maximize B given that $q = q^*$, its maximum capacity.

Now look at the diagram on this page. We have drawn three bonus functions I, II and III. Function II represents setting target above q^*. The achievable portion of it is depicted in solid lines, while the "notional" part is in dotted line. Note that it lies under I in $(0, \hat{q})$. So it is out! Function III represents setting a lower target $\hat{q} < q^*$ (i.e. $\hat{q}_{III}$). Up to point C, it is a superior strategy compared with I ($\hat{q}$). However, function I actually gives a higher bonus payment at $\hat{q} = q^*$. So, the manager of

the CPE should set $\hat{q} = q^*$! This scheme seems so nice and it solves both the informational problem and the execution problem!

References:

J. P. Bonin, "On Soviet Managerial Incentive Structures", Southern Economic Journal, 1976, pp.490-495.

M. Weitzman, "The New Soviet Incentive Model", Bell Journal of Economics, 1976, pp.251-257.

Quantity targets dynamics: The "ratchet" problem

The incentive model of quantity targets discussed in the last section is a static model. Put in a dynamic context, optimality may not be obtained and the so called "ratchet problem" may arise.

If we look at the diagram again, we should already sense some problems with the incentive scheme in a dynamic, multi-period context. I may be the optimal function in the one-period case. But then in the next period, say in t + 1, planners would use $q_t = q_t^* = \hat{q}_t$ as the basic information. On the basis of FTAL ("From the Achieved Level") planning, planners will add an amount to $q_t = q_t^* = \hat{q}_t$ in t + 1 and suggest a target $\bar{q}_{t+1}$ which is very high. This would create problems for the CPEs and depress their bonuses in the period t + 1.

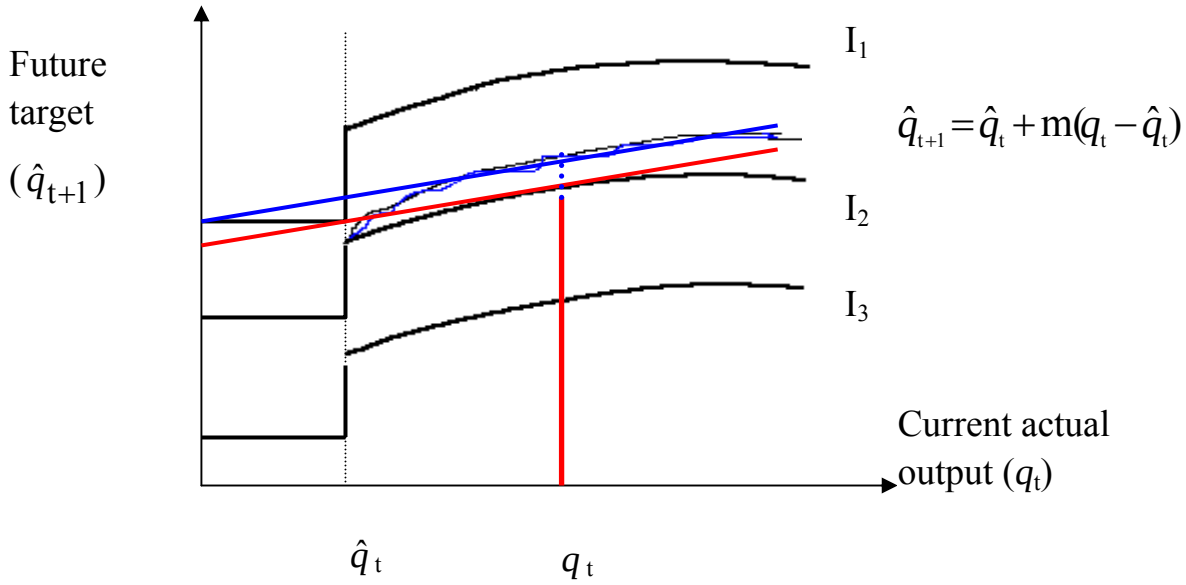
The reason is clear if we look at eq. (13) more carefully. If $\bar{q}$ is high, $(\hat{q} - \bar{q})$ will be relatively small because it becomes difficult for the enterprises to agree with the planners on a $\hat{q}$ which is much greater than $\bar{q}$. So $\beta(\hat{q} - \bar{q})$, i.e. the bonus that is obtained from targeting, will be smaller in t + 1 if the enterprise performs well in period t.

On the other hand, with a relatively high target $\hat{q}$, it would be difficult for the CPEs to achieve over-fulfillment of the target ---- $\alpha(q - \hat{q})$ will then be small. The danger of under-fulfillment and hence the penalty -- $\gamma(q - \hat{q})$ is however relatively high.

Overall, therefore, optimal performance in t may lead to low bonus payments in t + 1. Planners' requirements are like a "ratchet" that moves only in one direction. From the CPEs' perspective, it may be beneficial not to give the best performance (and to reveal its maximum

productive capacity q^*) in any time period, if the objective is to maximize its own interest, i.e. max. B over the long run. Under such a tactical move, X-inefficiency would arise.

In a simplified version, the dilemma confronting a typical CPE under FTAL planning and quantity-target incentive scheme can be illustrated by Fig. 3.2 in Buck's book (p.58). We change his notation to make it consistent with ours:



Buck's example (1) assumes a linear FTAL mark-up (m). So $\hat{q}_{t+1} = \hat{q}_t + m(q_t - \hat{q}_t)$, and (2) postulates that actual output $q_t < \hat{q}_t$ goes unrewarded, the achievement of $\hat{q}_t$ gets a lump-sum bonus $\overline{B}$, and higher outputs attract a bonus of $\alpha(q_t - \hat{q}_t)$.

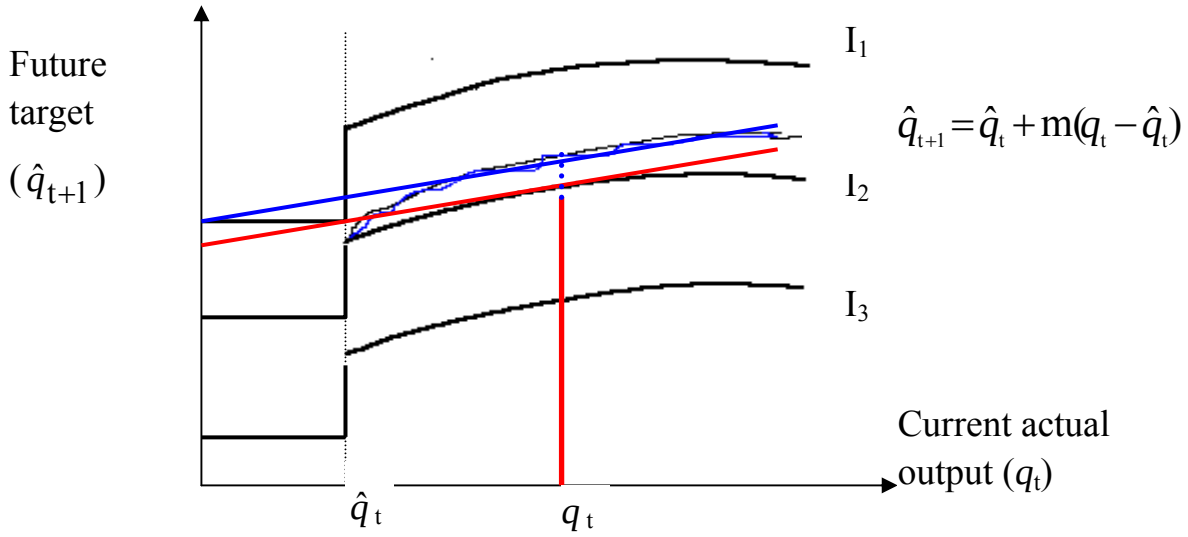
(1) implies a "future target function" of the form

$$\hat{q}_{t+1} = \hat{q}_t + m(q_t - \hat{q}_t) \quad \text{----------} \quad (14)$$

which is just like a budget line – a constraint.

(2) implies indifference curves of the peculiar shapes of I_1, I_2 and I_3.

- because higher future targets mean disutility as it becomes more difficult to get bonus in the future, $I_1 < I_2 < I_3$.
- Shape : $0 - \hat{q}_t$: unrewarded, $\therefore$ horizontal
  : at $\hat{q}_t$, a 'step' upward because of $\overline{B}$
  : $\hat{q}_t$ and beyond, dome-shaped because of increasing disutility of attaining future targets.



Now the key feature of the dilemma is the dome-shaped indifference curve which captures the interdependence between current output q_t, and future targets (and hence future output) - $\hat{q}_{t+1}$ and q_{t+1}.Without this interdependence, the CPE's indifference curve would be steeper, and the equilibrium output would be higher. In other words, this interdependence causes enterprises to hold back current output, q_t, and thus creates X-inefficiency. * Note that Buck's model can in some ways be tackled by the model of incentive we presented on pp.6-8. See Buck, section 3.3, pp.60-62, where eq. (13)

$$B = \begin{cases} \bar{B} + \beta(\hat{q} - \bar{q}) + \alpha(q - \hat{q}) & \text{if } q \geq \hat{q} \\ \bar{B} + \beta(\hat{q} - \bar{q}) + \gamma(q - \hat{q}) & \text{if } q < \hat{q} \end{cases}$$

is referred to as the "contract bridge" rule. However, as we showed above, X-inefficiency remains.

* The model can easily be generalized to **non-quantity targets**. It is not easy to deal with the ratchet problem once we confront the fact that there is a divergence of goals between the CPEs and the planners under FTAL planning. As 潘振民，羅首初，《社會主義微觀經濟均衡論》(頁 155-157) shows, "perverse" results could emerge.

e.g. (i) if the planners put pressure on the CPEs by imposing a larger m (i.e. 'forcing' the enterprises to perform even better in the next period), the $\hat{q}_{t+1}$ function would become even steeper. Eventually, actual q_t will be smaller; (ii) higher q_t can be achieved by "perverse" steepening of the indifference curves through short-term behaviour (短期行為) of the managers or workers of CPEs, who care more about B in t than B in t+1!

The Ratchet Principle: a Chinese Criticism

Reference, 潘振民，羅首初，《社會主義微觀經濟均衡論》(頁 157-167).

(A) Criticisms of the Ratchet Principle

(i) The assumption of "bonus maximization" on the part of the CPEs is incorrect, particularly in China.

(ii) The relationship between the planners and the CPEs is characteristic of the "Soviet" model (where there is no dialogue between the two) rather than the actual ("Chinese") model where "dialogue" (對話) and "conference" (會議) are facts of life in the planning system.
i.e. the ratchet model does not take into full account the institutional reality of socialist economies.

(iii) Through "dialogue", the information flow between the planners and the CPEs can be facilitated and strategic behaviour be constrained, e.g. in the figure on p.11,

$$\hat{q}_{t+1} = \hat{q}_t + m(q_t - \hat{q}_t)$$

$$\hat{q}_{t+1} = \underbrace{(1-m)\hat{q}_t}_{\text{intercept}} + \underbrace{m q_t}_{\text{slope}}$$

If m is increased, the intercept is reduced but the slope is increased, output is not necessarily increased. However, the indifference curve may also be steeper because of lower target for t+1 and higher bonuses, so output may be increased and X-inefficiency reduced. In other words, the ratchet effect can be contained by dialogue and conference.

** It is just like turning a non-cooperative game into a co-operative game.