THE NEW SOVIET INCENTIVE MODEL

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Number 141 October, 1974

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Summary

A new reform in the Soviet economy makes the size of the bonus fund depend on the plan target as well as the degree to which it has been fulfilled. By instituting this change, Soviet planners hope to stimulate more ambitious plans. The present paper develops a theoretical analysis of this novel and interesting approach to economic planning.

Introduction

Designing a good system of incentives is a problem that has been with us for a long time. In principle such a system ought to encourage individuals to do what is right by rewarding them for carrying out socially desirable policies. Unfortunately it is not easy to make an incentive system which is altogether flawless. Sometimes the defects are not evident at first, but they almost always make themselves known eventually.

While the incentive problem is by no means unique to a planned economy, it does take on special relevance in that context. Soviet planners have had mixed degrees of success in grappling with it over the years. Just recently there has been a major reform of the Soviet incentive structure. The new system is quite unlike what went before. It is relatively sophisticated and has some intriguing properties. My hope is that an analysis of the Soviet model may be of interest to a wide audience, since similar problems of motivation and coordination occur in many contexts.

1 This reform was intended to be instituted during the Ninth Five Year Plan and was inaugurated in 1971. Conversion over to it seems to have been spread throughout the plan period, and there are reports even now of enterprises changing over. An excellent survey of the new reform, as well as of the background to it, is given in Berliner [1974]. Veselkov [1968] contains a good description of the preceding debate about incentive systems. One of the earliest proposals was that of Liberman [1962].
The Model

Our aim is to focus directly on the analytical essence of the new reward structure. Naturally a great many other considerations not of direct relevance are going to be abstracted away in doing this.

Suppose for simplicity the planners are concerned with but a single performance indicator, denoted y. Usually y will symbolize output, but sometimes profits, or perhaps productivity, depending on the context. 2

A good incentive structure should have the following properties:

1) it encourages the enterprise to make y as big as possible,

2) it encourages the enterprise to reveal beforehand approximately what y will be,

3) it is relatively simple.

The conflict between 1) and 2) is a major difficulty with standard piecework type reward schemes in a planning context. It is in the interest of the manager (or worker) to convince his superiors that y is likely to be small, thereby entitling him to a lower target and a bonus which is easier to attain.

This creates a built in tendency for misrepresentation. To make things worse, planners and enterprises find themselves locked into the tense roles of adversaries in a gaming situation. The planners will typically need to hire a small army of expert assessors to fix the targets. Even then, there will be bickering about standards on both sides. If the target is set too low or too high, it has bad consequences all around

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2 Currently there are three major success indicators: value of output, profit rate, and labor productivity. In what follows we implicitly assume that inputs and the product mix are fixed, so that the issue of changing them does not arise.
(and the planners are never really sure, beforehand, what it ought to be). A target which is set too low will not ordinarily lure enterprise managers to overfulfill by a conspicuous margin because next period's plan target will start off with this period's performance as a point of departure (the well-known "ratchet principle"). Even if above-plan output is not adversely affected, such output is of little use unless it has been anticipated. Setting overtaut targets is also undesirable. Aside from the bad morale such action engenders, there will be the inevitable supply foul-ups as the plan breaks down, with secondary and tertiary losses multiplying throughout the economy. 3

Note that the combination of 1) with 2) is the basic flaw in the usual piecework incentive scheme. If the center is interested only in 1), most any reward proportional to y should suffice. 4 Yet this is precisely the case where economic planning could be abandoned because no coordination is necessary. The primary reason for planning is the need for coordination. And in order to have tightly coordinated plans, it really is indispensible to know beforehand (at least approximately) who will be producing what. This is especially critical for intermediate goods, where too little can be a disaster, and too much is practically worthless. So in planning situations there is a genuine conflict between 1) and 2).

By making the bonus size depend on the plan target, the new reform proposes to counter the built in tendency for managers to under-represent


4 Many problems or difficulties would remain of course, but I think it is fair to say that they are less compelling than the basic contradiction between 1) and 2).
their potential in seeking low assignments. Analytically the new system works as follows.  

There are three stages. In the first or preliminary phase the planners (on the basis of their own best current knowledge) assign to the enterprise a tentative target $\tilde{y}$ and a tentative bonus fund $\hat{B}$ for meeting that target. Also made available is a set of bonus coefficients $\alpha, \beta, \gamma$ whose role will be explained.  

In the second or planning phase, the enterprise has the option of selecting a larger (or smaller) plan target $\hat{y}$ with a correspondingly larger (or smaller) planned bonus fund for meeting it, $\hat{B}$, according to the formula:

$$\hat{B} = \hat{B} + \beta(\hat{y} - \tilde{y})$$

However $\hat{B}$ is only the planned bonus fund (which the enterprise would receive if it actually ended up producing the targeted amount $\hat{y}$). In the third or implementation stage, when the enterprise ends up producing amount $y$ it actually receives the bonus fund

$$B = \begin{cases} \hat{B} + \alpha(y - \hat{y}) & : y \geq \hat{y} \quad \text{(overfulfillment)} \\ \hat{B} - \gamma(\hat{y} - y) & : y < \hat{y} \quad \text{(underfulfillment)} \end{cases}$$

The final stage is thus similar to the old system except for one important difference. In the old system $\hat{B}$ and $\hat{y}$ were fixed by the planners,

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5 The description is based primarily on the supplement to Ekonomicheskaya Gazeta 1971 no. 22 and an article in the same journal 1972 no. 23, pp. 15-16.

6 The fond material'nogo pooshchreniia, which can be used for a variety of purposes, including paying out bonuses to managers and workers. See Berliner [1974] for more details.

7 In principle the numbers for each year are all set at the beginning of the five year plan and are intended not to be changed later. It remains an open question what is supposed to happen, e.g., if the planners see that the situation has changed.
in consultation with the enterprise. Now they are selected by the enterprise according to the multi-stage procedure just outlined.

In order for the new system to have the proper incentive effects, \( \alpha \), \( \beta \), and \( \gamma \) must be set so that

\[
0 < \alpha < \beta < \gamma. \tag{3}
\]

This conclusion has not escaped the attention of Soviet planners \(^8\) and the standards in *Ekonomicheskaya Gazeta* specify that \( \gamma \) shall be at least 30\% greater and \( \alpha \) at least 30\% less than \( \beta \).

Now a very basic question which the enterprise must answer is this. What is the optimal self-selected target \( \hat{\gamma} \)? In their turn the planners would like to know the answer to the following question. What relation does the optimal self-selected target \( \hat{\gamma} \) bear to the actual output \( \gamma \)?

First note that if the enterprise knows for sure how much \( \gamma \) can be produced, it will always get the maximum bonus by setting \( \hat{\gamma} \) equal to that value. So there is an incentive to be truthful in this case.

Now suppose a small amount of uncertainty in \( \gamma \), small enough to permit us to use the expected value hypothesis. The probability density function of \( \gamma \) is \( f(\gamma) \). By hypothesis, the enterprise will choose \( \hat{\gamma} \) to maximize the expected bonus:

\[
\hat{\gamma} = \arg\max_{\gamma} \int_{-\infty}^{\infty} \left[ (\bar{\beta} + \beta(\hat{\gamma} - \gamma)) + \gamma(\gamma - \hat{\gamma}) \right] f(\gamma) d\gamma.
\]

Differentiating (4) with respect to \( \hat{\gamma} \) and setting the result equal to zero yields (after cancelling out terms)

\(^8\) Veselkov [1973], for example, lays great stress on it.
\[ \int_{-\infty}^{\hat{y}} (\gamma - \beta) f(y) dy = \int_{\hat{y}}^{\infty} (\beta - \alpha) f(y) dy. \]  

(5)

Using the fact that \( \int_{-\infty}^{\infty} f(y) dy = 1 \), the above expression becomes

\[ P(y > \hat{y}) = \frac{\gamma - \beta}{\gamma - \alpha}, \]  

\[ P(y > \hat{y}) = \int_{\hat{y}}^{\infty} f(y) dy. \]  

(6)

where

Thus, the optimal self-selected target is such that the probability of ex-post plan fulfillment is the ratio of the difference in the coefficients \((\gamma - \beta)/(\gamma - \alpha)\). Note that it is only the relative (to each other) magnitudes of the coefficients which count in determining \(\hat{y}\).

Out of what looked like a complicated problem comes a simple solution. An optimal plan target lies somewhere between the minimum and maximum possible output levels, at a point where the incentive coefficients determine the percentile level for the probability that it can be met. With \(\alpha\) and \(\gamma\) differing from \(\beta\) by the same percentage, \(\hat{y}\) would be chosen as the median value of \(y\). By raising \(\alpha\), lowering \(\beta\), or raising \(\gamma\), the planners can induce more conservative (lower) plan targets, \(\hat{y}\), which are more likely to be fulfilled. By doing the opposite they can stimulate more ambitious targets.

If we introduce risk aversion in the form of a concave utility function, we get an analogous set of conclusions; only now the first order condition (5) would contain marginal utility (of the bonus) under the integral sign. If the center doesn't know the enterprise's utility function, in place of strict equality (6) it could only conclude that
due to the concavity of utility. The more pronounced the decrease in marginal utility, the more conservative the proposed plan target. Otherwise the qualitative properties of a solution are the same as for the expected value hypothesis.

What are the best levels of $\alpha$, $\beta$, and $\gamma$ from the center's point of view? They should be proportional to: the real social value of having an extra unit which has been pre-promised (for $\beta$); the real social value of having an extra unit unexpectedly delivered (for $\alpha$); the real social cost of being unexpectedly caught short by one unit (for $\gamma$). Setting the incentive coefficients this way (along with the expected value hypothesis) guarantees the enterprise will choose that target level which is socially optimal. Note that the various social costs and values will differ according to the situation. For example, $\gamma$ will probably be very high for basic intermediate goods and raw materials far back in the production process due to multiplier loss effects.  

As of the moment, there seems to be no evidence that Soviet planners have seriously analyzed how the incentive coefficients ought to be set.

We could complicate the model by including such things as "effort", but it really wouldn't add significantly to an understanding of the new incentive system. Likewise for analyzing several different targets (gross output, profitability, labor productivity) simultaneously imposed.

My own tentative conclusion is that the new Soviet incentive model looks like a clever innovation. And it seems to have some nice theoretical

\[ P(y>\hat{y}) > \frac{\gamma-\beta}{\gamma-\alpha}, \]  

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9 See Manove [1973] for a full discussion of this sort of thing.
properties. But we'll have to wait and see how it works in practice before passing final judgement.
References


