A NOTE ON MARINE TRANSPORT

MEASURES OF MERIT AS DEFINED

IN SOCIALIST REGIMES

by

Harry Benford

Department of Naval Architecture
and Marine Engineering
College of Engineering
The University of Michigan
Ann Arbor, Michigan 48109

In the free market environment we are unlikely to invest in a merchant ship unless we are reasonably sure that we shall eventually be repaid more than we invested. This we consider reasonable because a dollar in the hand today can buy more human satisfaction than the hope of a dollar in the future (even aside from inflation). In socialist countries the same reasoning generally applies. That is, funds for new productive facilities (for example, cargo ships) are not unlimited and require the sacrifice of more immediately desirable consumer goods or services. In selecting between productive alternatives, the question must always be raised: Which will be likely to return the largest margin of cash over and above the first cost? All other things being equal, the alternative promising the greatest margin (or quickest payback) will be most beneficial to the state.

One important difference between private enterprise and state ownership has to do with how the investment funds are raised and repaid. In free market economies the investment comes from voluntary sources: usually a combination of individuals who become part-owners (i.e. stockholders) of some private company, and banks that lend money at a fixed rate of interest. In socialist countries the investment is financed by the state itself, which raises the cash largely from the labor of its citizens, perhaps supplemented with loans from foreign sources.

What happens when a facility starts producing income over and above its operating costs? In the free market milieu that cash is typically divided four ways:

*The bank is repaid a fixed portion of its loan plus interest (i.e., rent money for the loan).

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*The federal government collects a share, which is at least

partly justified by the commercial, defense, and educational

infrastructure established with public funds.

*The company retains a part so as to enlarge its scope of

operations, or overcome inflation, or both.

*The stock holders are rewarded (if any spare cash remains)

in the form of dividends or added stock.

In socialist countries, of course, the spare cash returns to the state,

whose political leaders then decide what further use to make of it. In gener-

al, I am told, the organizational unit that earned the money is likely to be

allowed to retain most of it. Or, it may be distributed among other members

of the same industry. The political leaders may also redistribute the wealth

with other ends in mind:

*Other kinds of producers' goods

*Consumers' goods

*Military expenses

*Health, education, and general welfare

*Repayment of loans from foreign sources

*Overcoming unemployment.

Thus, although there are differences as to the division of the expected

returns, capitalists and socialists both aim to acquire producers' goods that

will more than pay for themselves. Their measures of merit should therefore

be somewhat similar, and this often appears to be the case. There are differ-

ences in terminology, but the analytical techniques seem to be roughly parallel.

In either environment, decisions are seldom based on economic criteria alone. Any decision makers must also deal with intangible considerations: important factors that cannot be readily weighed in monetary terms. This is expecially true in socialist regimes, where the leadership is particularly sensitive to political effects. Fundamentally uneconomic projects may be undertaken, for example, simply to reduce unemployment.

Reference 1 was written by a pair of authorities (Prof. Yang and Mr. Wu) in The People's Republic of China. In it they discuss measures of merit applicable to cargo ship design. Although they rely heavily on standard works from this country and England, they also touch on an approach that seems to them appropriate to The People's Republic of China. They suggest a measure of merit that apparently originated in the USSR and was introduced into China in the 1950's. They call it the "synthetical economic criterion" (SEC), which they define as:

$$SEC = S + \Delta p \tag{1}$$

where

S = unit cost of transport

$$S = \frac{Y + \dfrac{P}{N}}{C} \tag{2}$$

in which

Y = annual operating costs (assumed uniform)

P = initial investment

N = economic life in years

C = annual transport capacity, tons

also

Δ = "average social investment coefficient"

and

p = invested cost per ton of annual transport capacity

$$p = \frac{P}{C} \tag{3}$$

Substituting Eq. (2) and (3) into Eq. (1):

$$SEC = \frac{Y + \frac{P}{N}}{C} + \Delta \frac{P}{C}$$

$$= \frac{Y + \frac{P}{N} + \Delta P}{C}$$

$$= \frac{Y + \left(\frac{1}{N} + \Delta\right)P}{C} \tag{4}$$

Yang and Wu also introduce an expression that they call the "average social payback period of investment," abbreviated T . They further define T as the reciprocal of the "average social investment coefficient," i.e., Δ . Thus

$$T = \frac{1}{\Delta} \tag{5}$$

or

$$\Delta = \frac{1}{T} \tag{6}$$

If we substitute Eq. (6) into Eq. (4) we have

$$SEC = \frac{Y + \left(\frac{1}{N} + \frac{1}{T}\right)P}{C} \tag{7}$$

Engineers familiar with free market economics may recognize that $\left(\frac{1}{N} + \frac{1}{T}\right)P$ is what we call the annual cost of capital recovery. The expression $\left(\frac{1}{N} + \frac{1}{T}\right)$, of course, is what we call the capital recovery factor, CR . The term Δ , then, is simply the increment appended to $\frac{1}{N}$ in order to arrive at a capital recovery factor that will recognize that the investment should more than pay for itself. It corresponds, in short, to interest (hence profits) on the venture.

Continuing the analogy, the expression $Y + \left(\frac{1}{N} + \frac{1}{T}\right)P$ is equivalent to average annual cost, AAC :

$$AAC = Y + (CR)P$$

By now it should be obvious to you that SEC , the synthetical economic criterion, is exactly parallel to the old familiar RFR , the required freight rate:

$$RFR = \frac{Y + (CR)P}{C} \tag{8}$$

Thus, although profits (expressed as interest) are considered anathema in socialist regimes, their planners recognize the time-value of money. The expression $\left(\frac{1}{N} + \frac{1}{T}\right)$ implies an interest rate because it is, indeed, a capital recovery factor:

$$\left(\frac{1}{N} + \frac{1}{T}\right) = (CR - i - N) \tag{9}$$

For example, if N is specified as 20 years and T is specified as 10 years, we have:

$$(CR - i - 20) = \frac{1}{20} + \frac{1}{10} = 0.15 \quad ,$$

which corresponds to an interest rate of just under 14 percent.

Yang and Wu give no clue as to what value of T is considered appropriate in The People's Republic of China. They do, however, present a table (reproduced here as Table 1) that shows T ranging approximately from 6 to 15 years, and interest ranging from 10 to 20 percent. (We have taken the liberty of adding the corresponding capital recovery factors for each combination of N and i .)

Yang and Wu cite a Chinese paper consisting of translations of foreign papers (shown here as Reference 2). That reference is quoted as stating that in the USSR and several Eastern European countries use is made of a measure of merit called "lowest discount charge," or LDC -- which upon examination also turns out to be exactly equivalent to a required freight rate. That is:

$$LDC = RFR = \frac{Y + (CR)P}{C}$$

and they call CR the "specified coefficient of investment" rather than capital recovery factor. The statement is then made that the USSR specifies that the coefficient of investment of the whole national economy should be no lower than 12 percent.

Table 1: Average Social Investment

Coefficients (Δ), Average Social Payback Periods (T), and Capi-

tal Recovery Factors (CR) as Functions of Economic Life (N) and

Interest Rate (i)

Interest Rate	Factor	Economic Life: N		
		20	25	30
10%	Δ	.0675	.0702	.0728
	T	14.82	14.25	13.74
	CR	.1175	.1102	.1061
20%	Δ	.1098	.1147	.1190
	T	9.11	8.72	8.41
	CR	.1598	.1547	.1523
30%	Δ	.1554	.1621	.1675
	T	6.44	6.17	5.97
	CR	.2054	.2021	.2008

Note: $$CR = \frac{i(1+i)^N}{(1+i)^N - 1}$$

$$T = \frac{1}{CR - \frac{1}{N}}$$

$$\Delta = \frac{1}{T}$$

Yang and Wu note that RFR may substitute for LDC , then add, "It is worth pointing out that an interest rate i obtained in this way should be understood as social rate of discount (SDR)."

There are two things to consider in the above:

1) The USSR may well assign lower values of CR to those sectors of its economy that it wants to encourage for strictly political purposes. The merchant marine might be a case in point. More on this in a moment.

2) The assigned value of CR really ought to be adjusted for expected economic life. For example, if CR equals 12 percent, interest rates would vary with economic life as follows:

Economic life, N:	5	10	20	25 or above
Interest rate, i:	negative	0	10.3%	12%

In a recent letter (3) Professor Yang states that the meaning of Δ , the "average social investment coefficient, is rather fuzzy..." He adds:

...The value of Δ is difficult to decide, so that the criterion has not been widely employed. Certainly different Δ values should be assigned to different kinds of enterprises. [In] recent years we [have] gradually adopted your standard criteria, and find that SEC is closely related to RFR .

Professor Yang also explains that basic services, such as public transport, are deliberately operated at a loss. In other cases it is considered appropriate just to break even. That leads to a Δ value of zero, so that the economic

criterion reduces to the unit of cost transport:

$$S = \frac{Y + \dfrac{P}{N}}{C} \qquad (2)$$

The unit cost of transport can be thought of as the extreme case of a required freight rate based on zero profit and zero tax. That makes little sense in strict economic terms, but may make all kinds of sense in political terms.

In a more recently received publication (4), Professor Yu and his co-author, Zhang Renqyi, discuss measures of merit in some detail. They state that the criteria outlined above are still considered appropriate. In the future, however, as borrowed capital begins to play a large role -- they imply that greater emphasis should be placed on the time value of money. They go on to suggest the use of such standard evaluators as NPV, RFR, and NPVI. In these they state that interest rates are generally between 8 and 10 percent, although they may be as high as 15 to 20 percent. Since all cash flows belong to the state there is no need to consider taxes. (Whether you want to conclude that socialist enterprises have zero tax or a 100 percent tax is a delicate point of economic-political philosophy that we shall not ponder here -- except to recog-nize the socialists' inherent advantage in not having to retain the services of tax accountants and lawyers.)

In summary, although differences exist between East and West as regards the distribution of wealth, the methods of evaluating engineering decisions are often essentially the same. The big difference comes in the weight given to political factors in the East.

Acknowledgements

References

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