Discounting in the presence of inflation—the engineer giving evidence in a court of law

by O. L. PAPENDORF*, Pr. Eng., D.Sc. (Eng.)

SYNOPSIS

For purposes of simplification, a case is presented for an engineer to discount cash flows in real rather than in current terms when giving evidence in a court of law. The difference between the two methods is highlighted, and a recommendation is made in the case where differential rates apply.

SAMEVATTING

Ten einde te vereenvoudig word 'n saak uitgemaak vir kontantvloeiberekenings in reële pleks van in geldwaardes in die geval waar deskundige getuienis in 'n hof gelewer moet word. Die verskil tussen die twee metodes word uitgelig en 'n aanbeveling gemaak in die geval waar differensiële koerse geld.

This brief note is directed primarily at the mining engineeer who is required to give expert evidence in a court of law on the value of, say, mineralized land that is to be expropriated by the State for public use. Without a doubt, he will find the experience extremely frustrating, for the process of endorsing or refuting the barrage of questions directed at him (the 'yes' and 'no' process) is hardly conducive to orderly thinking. Furthermore, the court requires the replies to be framed as simply as possible. Lengthy cash flows and involved calculations should therefore be avoided. Even a pocket-size computer may become an embarrassment, for it invariably misbehaves in the tense atmosphere of a court of law.

Giving Evidence

There are usually other witnesses, not necessarily experts but persons with a great deal of practical experience in the exploitation of the mineral in question, who, for want of technical and perhaps financial background, fail to present their views convincingly. This is unfortunate since it may result in conditions prejudicial to the expert's evidence. For example, a case comes to mind of a successful businessman who was explaining how he would value a small silica mine. His words were something to this effect: 'In these inflationary times I simply tote up the profits I am likely to make, deduct 10 per cent for risk, and there is my value of the mine! Don't ask me to theorize on this, but I know I am right'. What did he in fact say? By adding up the annual income, he was discounting at no interest at all. However, the deduction of 10 per cent from the total is tantamount to at least a low rate of interest. One would not be wrong in guessing that what he really meant was that the inflation rate just about equalled the risk rate and therefore virtually cancelled it.

Discounting Procedure[1]

Since a cash flow can be expressed in *constant* terms (also known as *real*) and *money* terms (also known as *current*), the present value, P, of a cash flow is

$$P=\sum_{j=1}^{n} Ac_j\,(1+\beta)^{-j}\ , \quad \ldots\ldots\ldots\ (1)$$

where Ac is the cash flow in constant (or real) terms, and $(1+\beta)^{-1}=(1+r)/(1+i)$, r being the rate of inflation and i the discount rate applicable to cash flows in current terms, and j the number of the year from 1 to the final year n.

$$\text{Again, } P=\sum_{j=1}^{n} Am_j\,(1+i)^{-j}\ , \quad \ldots\ldots\ldots\ (2)$$

where Am is the cash flow in money (or current) terms.

To derive the rate β, i.e. the effective discount rate applicable to cash flows in real terms, one must put

$$1+\beta=\frac{1+i}{1+r}\ =e^{\ln(1+i)-\ln(1+r)}.$$

$$\text{Therefore, } \beta=e^{\ln(1+i)-\ln(1+r)}-1.$$

Also, by straight division,

$$1+\beta=\frac{1+i}{1+r}\ =1+i-r-ir+r^2+ir^2-r^3-\ \ldots\ldots$$

$$\text{Therefore, } \beta=i-r-ir+r^2+ir^2-r^3-\ \ldots\ldots\ldots$$

In practice, the term $i-r$ gives a sufficiently close approximation to β and is generally employed; however, when $i-r$ is large, the approximation should not be used unless the next two terms $-ir+r^2$ are added, but that would probably take longer than the calculation of β by the use of logarithms. As a practical example, if a cash flow of R100 p.a. in *constant* terms is discounted over a period, n, of 5 years, the investment rate, i, being 15 per cent and the inflation rate, r, being 12 per cent,

$$P=\sum_{j=1}^{5} 100_j(1+\beta)^{-j}\ ,$$

$$\text{where } \beta=e^{\ln 1{,}15-\ln 1{,}12}-1$$

$$=2{,}6786 \text{ per cent}$$

$$=\text{R}462{,}20\ \ldots\ldots\ldots\ldots\ (3)$$

If, instead of working out β, we use the term $i-r$, then

$$P=\text{R}457{,}97.$$

In the event of the cash flow being in *money* terms with a price-relative $1+r$, the annual cash flows will be $100_j(1+r)^j$ and

$$P=\sum_{j=1}^{5} 100_j(1+r)^j\,(1+i)^{-j}$$

$$=\text{R}462{,}20,\ \ldots\ldots\ldots\ldots\ (4)$$

which agrees with (3).

*Mining Consultant, P.O. Box 1497, Krugersdorp 1740, Transvaal.

© 1981.

Care must be exercised in the assumption that $A_m = A_c(1+r)$. Generally, if prices and costs are determined by market forces, both escalate at the inflation rate, and unescalated estimates will effectively be in constant terms. On the other hand, if future prices and costs are expected to escalate at rates differing from the inflation rate due, for example, to long-term contractual relationships such as royalty and transport agreements, then the estimates should be made in *money* terms. The engineer will find his task less onerous when giving evidence if he is able to adhere to unescalated estimates, which implies that he will have to confidently predict that long-term contracts in terms of which the cash flow will be determined will contain escalation clauses linked directly to the inflation rate.

Reference

1. BIERMAN, H., and SMIDT, S. *The capital budgeting decision.* 3rd edition, 1966, pp. 268-277.

Refining of precious metals

The International Precious Metals Institute (IPMI) has announced plans to conduct a Second Educational Seminar on the Recovery and Refining of Precious Metals on 10th to 13th March, 1981, in San Diego, California.

IPMI received an overwhelming response to its first Refining Seminar, which was held recently at Skytop, Pennsylvania, and many who wished to attend could not be accommodated. For the Second Seminar, Dr George Foo, Refining Specialist of the Western Electrical Company, has again been requested to organize the the technical programme. General Co-chairmen for the seminar are Mr Louis Hirbour, Technic, Inc., and Mr Gerry Brown, Electronic Reclamation Service, both located in Anaheim, California.

The Seminar will cover the fundamentals and current practice in the refining of precious metals. Sessions in primary and secondary recovery methods will be held. The Seminar is one of a series of educational courses being conducted by IPMI, whose purpose is to serve the technical and educational needs of the precious metals community.

For further information, contact IPMI Headquarters, Polytechnic Institute of New York, 333 Jay Street, Brooklyn, New York 11201, telephone 212/625-3339 or 215/866-1211.

Complex tin ores

The Southeast Asia Tin Research and Development (SEATRAD) Centre is a regional organization formed by the Governments of Indonesia, Malaysia, and Thailand, with assistance from the United Nations, to conduct, coordinate, and promote research and training in the various fields of tin production, including geology, prospecting, mining, mineral processing, and smelting.

The SEATRAD Centre is organizing a seminar on 'Complex Tin Ores and Related Problems', which is to be held on 9th to 11th April, 1981, in Bandung, Indonesia. The seminar will be open to participants from all countries. It is expected that a field trip to one of the Indonesian tin islands (Bangka or Belitung) will be organized for the week following the seminar, probably from 12th to 18th April, 1981.

Enquiries should be addressed to The Director, SEATRAD Centre, 14 Tiger Lane, Ipoh, Malaysia. Telephone 517124 and 517833. Telegrams: TINCENTRE, IPOH.