PRESENT VALUE OF A MINE

The purpose of my paper is to demonstrate a method of calculating the present value of an existing mine. To do this I have used for an example a presently existing N.S.W. tin mine. However, it must be pointed out that this is intended purely as an example and the resultant conclusions should not be taken as a recommendation concerning the worth of this company.

The method basically is to project the company's future operations over the life of the mine to arrive at its profitability. The company's cash flow will then be discounted to try to calculate the intrinsic worth on the basis of these future cash flows.

The first step in the evaluation is to estimate ore reserves of the company including any likely additions to reserves from exploration. Future production and recovery rates for the life of the mine can then be guessed at. On table 1 the present stated reserve position of the company is shown.

computed from the results of detailed sampling.

"Indicated" ore is ore for which tonnage estimated is based largely boundary of the No. 1 ore body samples, or production data and partly from projections for a reasonable distance on geological evidence.

"Inferred" ore is ore for which tonnage estimated are based largely on the broad knowledge of the geological character of the deposit and for which there are few, if any, samples or measurements.

Regarding likely additions to the stated reserves, the last annual report of the company said that a programme of diamond drilling is in progress to test the extension of the No. 2 ore body at depth and some interesting tin mineralisation had been encountered. However, the report also said that exploratory drilling to delineate the southern boundary of the N.o 1 ore body gave no significant indications of

TABLE 1—PRESENT ORE RESERVES (approximate)

	Tons	Grade (%Sn)
Ore body 1 — indicated	517,000	0.42
Ore body 2 — indicated	666,000	0.38
Ore body 1 — inferred	21,000	0.40
Ore body 2 — inferred	129,000	0.40
Rough ore stockpile — measured	31,000	0.40
Old tailings Dumps — measured	94,000	0.74
Old tailings Dumps — inferred	70,000	0.74
	1,528,000	

Certain of the tailings dumps are held under option and, therefore, until the option is excerised, the reserves therein are classified as "inferred" rather than measured.

The definitions of the type of reserves shown are as follows.

"Measured" ore is, as its name suggests, ore for which tonnage is computed from dimensions established by workings, drill-holes or outcrops and for which the grade is

additional ore. Using this as a base and for the purposes of this exercise I have assumed that the No. 2 ore body will be increased by about double and that no increase to the No. 1 ore body reserves will be made. The grade of these new additions to reserves I have assumed to be 0.40% Sn, partly for convenience and partly because the grade of inferred reserves on the No. 2 ore body is 0.40%. One of the reasons

why I have been so generous with new additions is that if the price of tin were to rise on world markets there would be almost automatic increases to reserves simply by using a lower cut-off grade. The new reserve position that I have assumed is shown on table 2.

The resultant position is 2.4 million tons of ore, which is sufficient for eight years' production at 300,000 tons throughout a year. This rate is roughly equivalent to last year's production rate. Future production and recoveries over the life of the mine together with the resultant tin in concentrate output is therefore shown in table 3.

As a mix of the indicated ores of the No. 1 and No. 2 ore bodies is about 0.40% Sn, I have assumed a constant head grade over the eight years at 0.40%, except for when ore from the old tailing dumps are used. However, as the recovery from these dumps is likely to be below the "normal" recoveries of virgin ore, which has not been processed before, I have assumed a recovery of 31.35 per cent. This compares with a recovery on new ore of 58 per cent. which was the rate prevailing in 1967-68. By a strange coincidence the assumed recovery rate for both types of ore gives the same recovered grade, i.e., 0.232% Sn. The output of tin in concentrates over the eight years' life of the mine is therefore a steady 696 tons a year.

Now that we have production figures the next problem is what price the company will receive for its tin output. I have used three basic price alternatives here, the first being £1280 stg. or the International Tin Council buffer stock manager's "must buy" level. This can probably be regarded as a floor price. The other two prices I have used are £1350 stg. and £1400 stg. as possible prices. However, the

company chosen here exports its tin concentrates to be smelted, as Australian smelters cannot handle its product due to the lead impurities present. Therefore the price received by the company for its tin in concentrates must be lower to cover the costs of smelting, transport costs and a discount for the impurities present. An examination of the past prices received for the company's output shows that the price received for tin in concentrates in 1967 was $2665 compared with an average L.M.E. price of £1213 stg. —equivalent to $3033 at the prevailing exchange rate. This represents a differential of $368 a ton of tin in concentrates. Similarly, last year the price received was $2540 compared with an estimated average L.M.E. price of about £1360 stg.—equivalent to $2915. A differential again exists of the order of $374. Hence I have used a differential of $368 as a discount for impurities, etc., in converting the L.M.E. to Australian dollars. This gives prices of $2375 for £1280 stg., $2525 for £1350 stg., and $2632 for £1400 stg.

The gross realisable value for tin concentrates over the remaining eight years' life of the mine on the three bases is therefore $1,663,000, $1,767,000 and $1,842,000 respectively. These figures include an assumed amount of $10,000 coming from sundry income. Other income to accrue to the company will be through the sale of plant, etc., at the end of the mine life. As the company's plant in this case is reasonably modern and presumably in good condition, it will probably have some resale value.

However, the price received will depend to a large extent on whether a mining company exists nearby that can utilise the equipment. Cost of freight to a port, shipping costs, etc., will also be a factor. At this stage it is impossible to guess but I have put a figure of $290,000 or 10% of fixed assets as a possible realisation value at the end of a further eight years. Also an examination of last year's accounts shows a surplus of current assets over liabilities of about $112,000. However, this full amount would not be realised at the end of the mine life—some loss on the realisation of stores, etc., will occur. Therefore I have assumed a realisable value of $50,000 which has to be added to the realisation on fixed assets, making this figure now $340,000. However, a tax deduction would be available in the final year to the extent of $62,000. This is the loss on the sale of working assets.

On table 4 is my estimate of the likely costs the mine will incur over its life.

On the question of operating costs I have assumed a compounding rate of cost increases of 3% per annum from the base operating costs of $1300 obtained from the 1967-68 accounts. A 3% compounding rate seems to be reasonable as costs will rise at a greater rate as the open cut goes deeper. Also maintenance costs will also increase as equipment, especially dozers and end loaders, becomes older. I have ignored for this study capital expenditure for replacement purposes on this equipment. Other costs, mainly administrative expenses, are assumed to be constant at the 1967-68 rate of $99,000 per annum. An addition to these two types of costs in future years, however, will come from the withdrawal by the Commonwealth Government as from July 1, this year, of the export incentive ar-

TABLE 2—ASSUMED EVENTUAL RESERVES

	Tons	Grade (%Sn)
Ore body 1 — indicated	517,000	0.42
Ore body 2 — indicated	666,000	0.38
Ore body 1 — inferred	21,000	0.40
Ore body 2 — inferred	129,000	0.40
*Ore body 2 — assumed	872,000	0.40
Rough Ore stockpile — measured	31,000	0.40
Old tailings Dumps — measured	94,000	0.74
Old tailings Dumps — inferred	70,000	0.74
	2,400,000	

* Additions to stated reserves.

TABLE 3—PRODUCTION ESTIMATES

	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Tons Milled	288,754	297,589	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000
Head Grade %										
New ore	0.414	0.396	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40
Tailings	—	—	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74
Recovery %										
New ore	52	58	58	58	58	58	58	58	58	58
Tailings	—	—	31.34	31.34	31.34	31.34	31.34	31.34	31.34	31.34
Tin in Conc. (tons)	626.64	683.69	696	696	696	696	696	696	696	696

TABLE 4—COST SCHEDULE ($000's)

	1968	1969	1970	1971	1972	1973	1974	1975	1976
Operating costs (compounding at 3%)	1300	1339	1379	1421	1463	1507	1552	1599	1647
Other costs (administration, etc.)	99	99	99	99	99	99	99	99	99
Withdrawal of payroll tax rebate	—	10	10	10	10	10	10	10	10
TOTAL COSTS	1399	1448	1488	1530	1572	1616	1661	1708	1756

rangement whereby mining companies could earn a full rebate of payroll tax by exporting its product. The withdrawal of this rebate of 2½% of the wages bill, less $20,000, probably adds not more than $10,000 to costs, assuming a maximum wages bill of $420,000 p.a.

Royalty payments for last year to the government are already included in the cost figures. Royalty payments are based on 1½% of the gross value on old leases—2% on leases granted since 19th January this year—less treatment expenses and in this case a proportion of general expenses. Some adjustment therefore should be made to costs but any variation is unlikely to be of much significance to the results obtained, i.e., a variation of $200 in the price of tin would only present a maximum variation of about $2000. This is not significant enough to complicate this exercise with its introduction so I have made no adjustment to cost figures for royalty. Exploration costs have been assumed to be constant at the 1967-68 figure of about $5000, which is included in the $99,000 other costs. It is expected that this amount will be sufficient to prove up the extra tonnages on the No. 2 ore body, but I have assumed that it will not prove up any additional ore, even though exploration costs are continued until the end of the mine life.

On table 5 you will see the profit, before tax and depreciation, figures which are arrived at by deducting the total cost figures shown in table 4 from the income figures calculated previously, namely:

$1,663,000 @ $2375
$1,767,000 @ $2525
$1,842,000 @ $2632

TABLE 5—PROFIT BEFORE TAX AND DEPRECIATION ($000's)

	1969	1970	1971	1972	1973	1974	1975	1976
Gross profit @ $2,375	215	175	133	91	47	2	(45)	(93)
Gross profit @ $2,525	319	279	237	195	151	106	59	11
Gross profit @ $2,632	394	354	312	270	226	181	134	86

In addition to this income, however, must be added the realisation on the sale of assets at the end of the mine life, namely the $340,000. However, in the case of income incurred with the price of tin at $2375, we can assume that the company will cease operations at the end of 1974 and plant sold then, instead of when the ore is exhausted, as the company is unlikely to operate when no cash flow is being generated.

The taxation payable by the company, using the three different profit levels, is shown on table 6.

TABLE 6—TAXATION PAYABLE ($000's)

	1969	1970	1971	1972	1973	1974	1975	1976
Income @ $2,375	Nil	Nil	Nil	Nil	Nil	Nil	—	—
Income @ $2,525	Nil	Nil	Nil	Nil	Nil	Nil	Nil	52
Income @ $2,632	Nil	Nil	Nil	Nil	10	65	48	156

The liability for tax in this case can be calculated fairly simply by using past accounts and projected profit figures. We start with the total capital expenditure figure on fixed assets from the balance sheet, in this case $2.9 million. This includes a $10,000 commitment for capital expenditure not provided for in the accounts, but mentioned in the notes to the accounts for 1967-68. While this $10,000 is probably only a small part of future capital expenditure we will assume for this exercise that it is the total amount. From this $2.9 million is deducted the profits earned and depreciation charged since the company commenced operations in 1964. This leaves a net amount of $1,528,000 from which profit and depreciation can be further written off before taxation is incurred. Using the gross profit earned at a price of $2632 for tin as an example, table 7 will show how the tax was arrived at.

From the undepreciated capital expenditure at the beginning of the period shown in the first column is deducted the profit, before tax and depreciation, obtained from table 5 to give in column 3 an unclaimed residual capital expenditure figure at the end of the period. No tax will be payable by the company until this residual is exhausted. This situation prevails until 1973, when the gross taxable income, which is shown in column 4, then becomes positive. However, a partial exemption of income from tax is allowable for tin ores. Therefore, only 80% of income directly derived from mining is taxable, once liability is incurred. Of course, tax is charged at the full rate of 45% on the full amount of the depreciated realised value on the sale of plant and equipment. Column 5 shows the amount of exempt income which can be deducted from the gross taxable income to give the net taxable income in column 6. Column 7 gives the tax payable at the current rate of 45% of taxable income. Similar exercises are done to give the taxation payable figures for the other two price levels as shown earlier in table 6.

Table 8 shows the cash flow figures that result, from deducting the taxation payable from gross profit, after adding the $340,000 income from the sale of assets at the end of the mine life.

Also the 1969 figures have been reduced by an amount of $10,000, previously mentioned, as a capital expenditure commitment not provided for in the accounts. The resulting cash flow figures can now be defined as the amount of money generated by the company which is available for distribution to shareholders. It is equivalent to net profit plus depreciation. This amount, which is not needed in the business, if retained by the company will be available to earn extra interest which will eventually allow a larger payout, but theoretically it could be paid to the shareholders in the year in which it is made. If some of this cash flow is assumed to be used in further exploration or future capital expenditure, then the discountable cash flow would have to be reduced by the expected amount in the relevant year, but in

this case I have assumed these items to be nil. If the company is retaining funds over and above its future needs for exploration, development, etc., the cash flow will have to be modified to the extent that some assumptions may have to be made concerning the rate of return the company will receive on these funds. However, as this model assumes full payout by the company, it has not been complicated by the introduction of funds being retained over and above the company's needs.

A further examination of last year's accounts also shows that about $124,000 is payable in 1969 on term loans, but this figure could be paid out of existing current assets so no further adjustment has been made to table 8.

Before progressing further, it should be pointed out that another factor that can affect the figures here is a variation in the recovery rates. A quick look at table 3 will show that I have assumed the recovery rate to be 58%. A rise in the recovery rate from 58% to 60% would yield an extra 24 tons of tin in concentrate, or an extra $57,000 at $2375 a ton. A rise to 65% would yield an extra 84 tons of tin in concentrate, or an extra $199,500. This would be equivalent to a rise in the price of tin to the company from $2375 to $2662 a ton, or its equivalent of £1414 stg. a ton on the L.M.E.

Now to get back to the next step in the example we must choose an acceptable discount rate. The rate chosen represents the rate of return considered acceptable to the investor plus a loading for risks taken in the investment. I have used 8% and 10%, 8% reflecting for most investors the basic minimum discount rate as funds available to them could be used to generate about 8% in alternative investment opportunities, e.g., fixed interest securities. A more valid discount rate for this company would be 10% or higher to compensate for the risks involved in new ore proving up, etc. Table 9 gives both the discount factors at 8% and 10%, obtained from compound interest tables, and the resultant discounted cash flows which are obtained by multiplying the cash flow figures in table 8 by the discount factors.

These values are then totalled across and the resultant figure is the present value of the mine. This is equivalent to the figure that an investor would arrive at if he were valuing the mine for outright purchase. Finally, to obtain a present value per share simply divide the respective present values by the number of shares on issue—in this case 3,926,000 shares. The present values per share are shown on table 10.

TABLE 8—CASH FLOW FIGURES ($000's)

	1969	1970	1971	1972	1973	1974	1975	1976
@ $2,375	205	175	133	91	47	342	—	—
@ $2,525	309	279	237	195	151	106	59	299
@ $2,632	384	354	312	270	216	116	86	270

TABLE 10—PRESENT VALUE PER SHARE

Present value of mine per share = PRESENT VALUE / NUMBER OF SHARES ON ISSUE (3,926,000 shares)

	@ $2375	@ $2525	@ $2632
@ 8%	20 cents	32 cents	39 cents
@ 10%	18 cents	29 cents	36 cents

TABLE 7—EXAMPLE OF TAX CALCULATION ($000's)

	Undepreciated Capital Expenditure at beginning of period	Less gross Profit from table 5 ($2632) —plus proceeds on sale of assets at end of mine life	Unclaimed residual Capital Expenditure at end of period	Gross Taxable Income	Less exempt income (20% of mining profits)	Net Taxable Income	Tax at 45%
1969	1,528	394	1,134	Nil	—	Nil	—
1970	1,134	354	780	Nil	—	Nil	—
1971	780	312	468	Nil	—	Nil	—
1972	468	270	198	Nil	—	Nil	—
1973	198	226	Nil	28	5.6	22.4	10
1974	Nil	181	Nil	181	36.2	144.8	65
1975	Nil	134	Nil	134	26.8	107.2	48
1976	62 (loss of sale of stores, etc.)	426 (86 + 340)	Nil	364	17.2 (20% of 86)	346.8	156

TABLE 9—DISCOUNT FACTORS

	1st yr.	2nd yr.	3rd yr.	4th yr.	5th yr.	6th yr.	7th yr.	8th yr.
8%	.9302	.8653	.8050	.7488	.6966	.6480	.6028	.5607
10%	.9091	.8264	.7513	.6830	.6209	.5645	.5132	.4665

8% Discounted Cash Flows ($)

	1969	1970	1971	1972	1973	1974	1975	1976	Present Value
@ $2,375	199,993	151,428	107,065	68,141	32,740	221,616	—	—	**780,983**
@ $2,525	287,432	241,419	190,785	146,016	105,187	68,688	35,565	167,649	**1,242,741**
@ $2,632	357,197	306,316	251,160	202,176	150,466	75,168	51,841	151,389	**1,545,713**

10% Discounted Cash Flows ($)

@ $2,375	195,457	144,620	99,923	62,152	29,182	193,059	—	—	**724,393**
@ $2,525	280,912	230,566	178,058	133,185	93,756	59,837	30,279	139,484	**1,146,077**
@ $2,632	349,094	292,547	234,406	184,410	134,114	65,482	44,135	125,955	**1,430,143**