THE INVESTMENT VALUATION OF OIL EXPLORATION AREAS

by

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Synopsis

Although the discounted cash flow is used widely throughout the oil industry and by analysts to determine the value of discoveries it is seldom used to value oil exploration areas. This paper introduces a method of utilizing cash flows to establish a range of values for potentially recoverable barrels of oil. By integrating the results with the geologically assessed potential, the risks and the cost of and timing of exploration, an objective value of an area can be determined.

Other methods of permit valuation are also reviewed.

Introduction

Successful oil exploration companies not only look in the right place, they look at the right price.

Until it is successful the entire effort of an oil exploration company is essentially directed to finding oil, and its funds are spent on permit acquisition and exploration. Yet few companies, large or small, attempt to value permits. In exploration management, in allocation of funds and people, in investment and divestment decisions and in new capital raising, determination of the value of a company's permits should be of supreme importance. Exploration companies seldom undertake the exercise. Although they are armed with less information and cannot be expected to have the expert technical knowledge, permit valuation is generally left to investment advisors or merchant banks.

This paper introduces a method of permit valuation by assessment of potential reserves and risk analysis. The commonly used methods, unrelated to the geological merits of the permit, must not be dismissed and are firstly reviewed.

Past Expenditure

The first method is based on past expenditure. The "argument" is that an area is worth what has been spent on it. Clearly this cannot be supported. Suppose $10 million is to be spent on a permit to determine whether it has reserves or continuing potential. At the beginning of the project, with no money spent, permit holders are willing to spend $10 million (theirs or someone else's) and so the permit is certainly worth more than zero as the "past expenditure" argument would lead us to believe. At the end of the project, with the $10 million spent and, say, prospects exhausted, the permit is not worth $10 million, rather it is worthless. It would seem in fact, that there may often be an inverse relationship between expenditure and value.

And so we can dismiss the concept of expenditure relating to value. But pick up a balance sheet of an exploration company, and what is capitalised, what is reflected, in fact stated as an asset? Exploration expenditure! The value of an interest in a permit is recorded in the one public document published by the company as equal to the money spent on it. Under pressure of auditors, areas may be "written off" based essentially on the criteria of the amount of activity in the permit in the year under review. If the permit was active, activity being the drilling of the final dry hole in the area, then expenditure is capitalized and reflected as value. If it was inactive but with large undiscovered reserves then the auditors would "decide" that its value, as reflected in written off expenditure would be zero. Fortunately this archaic method of accounting is largely ignored by analysts.

Past expenditure as a value does have one redeeming feature and this must be acknowledged. In bringing in new partners, be they companies or new shareholders, there is an element of fairness recognised, and provided it is seen as only this then it can be used in arriving at an equitable arrangement in special situations.

Comparison to Farmins

Probably the most commonly used method of permit valuation is that of relating the value of an interest in a permit to farmins, ideally within the permit but also to those in adjacent or nearby permits. This method, which requires a close eye be kept on industry activity, is simple, and is the stockbrokers main tool.

Ramp Oil N.L. negotiates to earn a 40% interest in ATP500 by contributing 100% of a $2 million exploration programme.

Question: By this method, what is 20% interest worth?

Answer: 20% is worth one half (20% ÷ 40%) of the amount Ramp Oil is to pay for 40% interest less the proportional 20% share of the exploration programme to bring the 20% interest holder to the same stage of exploration.

That is:

Figure 1

$$20\% = \left(\frac{20}{40} \times \$2M\right) - (0.2 \times \$2M)$$
$$= \$0.6M$$

The pitfalls are

(a) the interest to be valued must be brought to the same stage of programme expenditure as the farminor's interest. This is simple algebra — an important but often ignored point

(b) the farmin transaction must be arm's length

(c) it must be recent

(d) if the farmin is an adjacent or nearby permit it must have comparable geology to the subject permit, and

(e) the nature of the farminor must be taken into account. For example new floats historically accept harsher terms than would industry as a whole.

Above all, this method, like all too many others is not an independent assessment of value. It is taking someone else's value and making an algebraic relationship.

Its most useful purpose is as a reference for negotiations, not for valuations.

Sale of Interests

Interests in permits are sometimes sold outright and provided such a transaction is recent and there has been no significant exploration events in or around the permit, it is hard to argue that this doesn't strictly relate to the value of the permit.

A number of sharebrokers proffer the argument that recent farmout terms, sale of interests or sharemarket capitalization of a relevant company, accurately determine the value of a permit. After all that's what the market is prepared to pay! It's just like a house isn't it? Even if the vendor thinks it's worth $200,000 but can only sell it for $100,000 well, isn't that its value?

As strong as this argument may be it does have its limitations. Firstly, it is the job of explorationists and advisors to be ahead of the market, not to follow it. Successful companies and investors are the original stakeholders, the leaders, not the followers. Secondly, the value of a permit is based on what it can return from the ground, as an investment and not as a flutter on a piece of real estate at the latest "in" address. This does not mean that interests in permits should not be sold, simply that the buyer should aim to purchase at less than the permit's intrinsic value.

Sale of interests and farmout terms, provided they have been recent transactions, cannot be ignored, and despite more sophisticated techniques they are often the only practical method of arriving at a value. In rank wildcat areas an intrinsic value cannot be objectively determined and one must rely on these "real estate" techniques.

Permit Work Commitments

Permit work commitments have been used for determining the value of a permit by the simple analogy that "if a company is willing to spend $8 million on a permit then industry must value the permit as $8 million". Although there is little to support this argument, there is some argument that the permit must be worth $8 million at a minimum. However, this is based entirely on the permit holder's view, hardly an objective, independent assessment.

The above methods of "valuing" permits have their uses, but these are almost totally restricted as a reference in negotiating farmin or farmout terms or otherwise acquiring interests in permits or companies. They are otherwise of little use to the oil explorer or the long term investor in the industry.

Intrinsic Value

In searching for oil we are looking for something of value. The something is oil or gas and its value can be determined by assessing what it costs to find and sell.

The accepted method of determining the value of a discovery is to draw up a cash flow and discount predicted future cash receipts. It is a variation of this method that this paper puts as the most appropriate for exploration permit valuation.

No matter how sophisticated the project, cash flows and the application of risks should, for this purpose be kept simple. Firstly, cash flows are simply that — cash in, cash out, net cash. Many so called "cash flows" are drawn up in constant dollars — no inflation, no escalation. Unless the author really believes this to be the case then this is not a cash flow. In this front end capital intensive industry where capital, operating costs and prices can be expected to increase at different rates, constant dollar "cash flows" may give very misleading results.

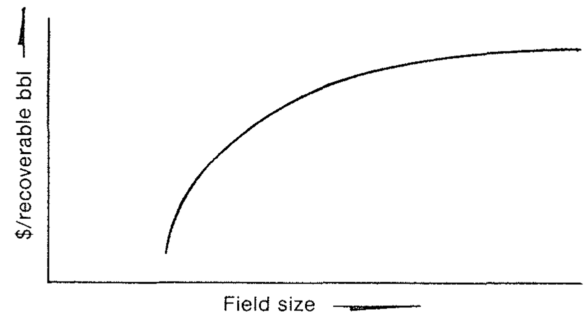
Cash flow construction is a quantitative expression of
(a) author's opinion of a project,
(b) of its technical aspects — production rates, decline, etc.,
(c) of ongoing development and operating costs and
(d) of the market for the product.
The author's assumptions must be clearly noted, if for no other reason that those that disagree can re-run the cash flow using revised assumptions.

Provided the author has drawn up the cash flow faithfully and believes that the field will produce the goods and oil prices are fairly predicted, then the discount rate applied to determine the present value is the opportunity rate of alternate investments. If your company purports to earn 30 per cent on investments, if its stated policy is to earn 30 per cent on all new investments but it has funds which, with reasonable time and opportunity can only be placed at 15 per cent pre-tax, then the present value of the cash flow is arrived at by discountng it, pre-tax at 15 per cent.

Given that the cash flow is of an oil field, then the present value divided by the barrels of oil produced gives the value per recoverable barrel in the ground.

The value per recoverable barrel in the ground will vary according to a number of factors, and these should be examined to determine their sensitivity. They are best displayed graphically. Here are some examples:—

Figure 2



Notice the steepness of the curve in the small field size range. In this area field size is critical and will be the main factor determining economic viability.

Figure 3

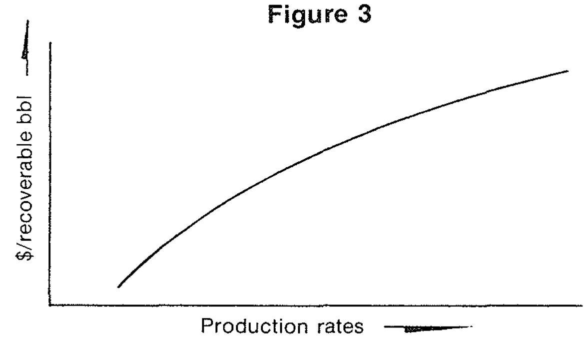
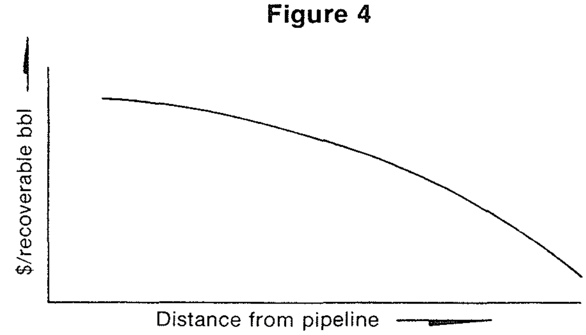


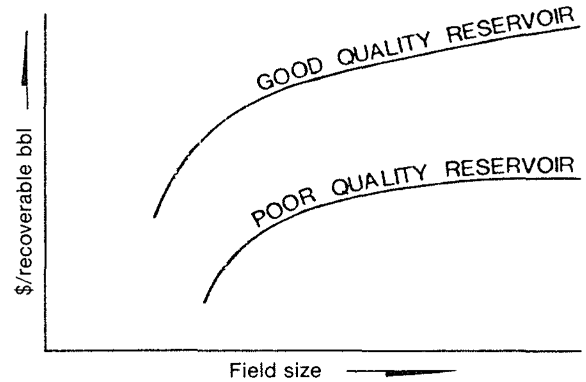
Figure 4



All factors will effect the value of all oil discoveries and in many cases the factors are related, for example field flow rate and field size often vary directly. Within reasonable limits the value per recoverable barrel of a Hutton Sandstone oil discovery will not vary greatly with field size. The value per recoverable barrel of an offshore Upper Barrow Group discovery will vary dramatically with size.

Many exploration permits have more than one important objective, or have two or more major play types.Value per recoverable barrel should be established in each case.

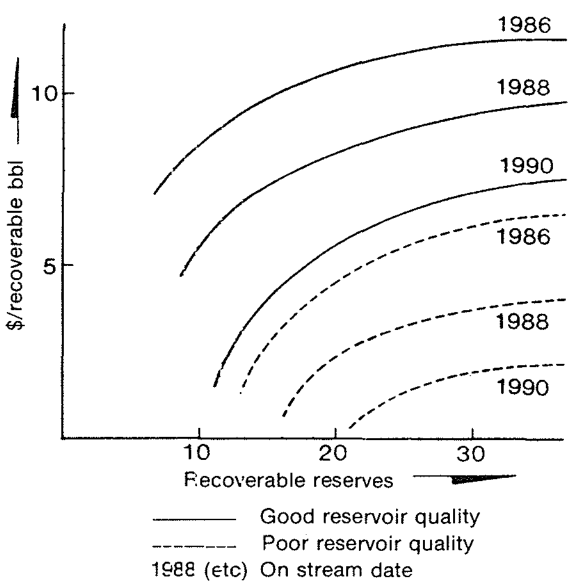
Figure 5



The value of a field depends on when it is discovered and comes on stream. The reduced value of the deferred cash flow must be determined to properly reflect expected exploration activity. In some cases delayed discovery may be partially offset by economies of scale — that is by making greater use of existing facilities.

Having established the main parameters influencing the value of discovered oil reserves, one then refers to the graph to determine the unrisked value of a prospect. Clearly it is necessary to be able to determine potential reserves, a subject not covered in this paper. Note that the time to come on stream will always be a factor.

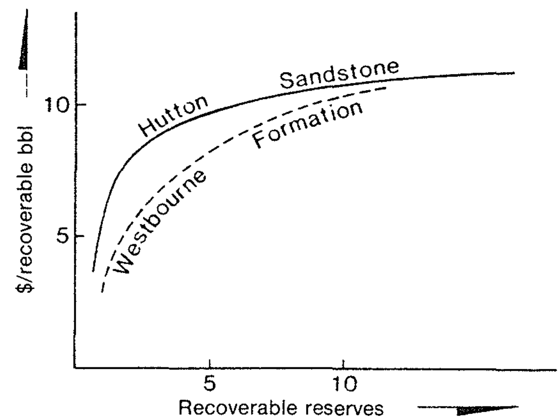
Figure 6
OFFSHORE CARNARVON



The offshore Carnarvon Basin is a useful illustration. This is an area with numerous target horizons and where depth of burial would appear to be the dominating influence over reservoir quality — oil in place, recovery factor and production rates. By examining only two reservoir types — shallow and deep — and constructing cash flows for fields of various size a great range of values can be estimated as shown in Figure No. 6.

Similarly in the Eromanga Basin the good characteristics of the Hutton Sandstone more than offset the shallow, lower cost, but poorer quality Westbourne reservoirs.

Figure 7
EROMANGA



The prospects can be tabulated as per Figure No. 8

Figure 8

Prospect	Potential reserves	Value per recoverable bbl	Potential value of prospect
	(millions of dollars)		
A	11	7	77
B	5	0	-
C	49	9	441
D	83	11	913

Risks have not been incorporated in the cash flows. There are certainly risks associated with field production, but the aim of the cash flows is to draw up realistic unrisked projections. If there is a risk that production figures will not be achieved, then reasonable lower figures should be used. If strikes may reduce production then this should be allowed for. Keep the cash flow simple. So much of it is based on estimates (inflation, project delay and so on) that over-sophistication often confuses the issue.

Having determined the value of yet to be made discoveries, the probability of achieving these results must now be considered. Oil exploration is a high risk business and these risks must be quantified.

From a technical standpoint, there are three main areas of risk (or probability factor) and the total risk is their product. Probability factors are rated 0 to 1.

The first is "will additional seismic confirm a drillable location?" With seismic complete and a well-site chosen the probability factor is 1. Should the feature be an anomoly detected on only one seismic line — a weak lead — the probability factor may be of the order of 0.2.

The second is "given a drillable structure, is seismic telling the truth?" Good quality seismic showing a high relief structure with four way dip covered by a 500 metre seismic grid, the probability factor may be 1. Widely spaced seismic lines of relatively poor quality shot over a low relief feature in an area known to have velocity variations may reduce this factor to 0.3 or so. This would have been the order of magnitude for this factor of many Eromanga prospects drilled earlier this decade.

The third is the geologic factor. This is made up of numerous factors — seal, reservoir, source etc. It is never 1. When it falls to a very low number, say less than 0.05, it is almost impossible to be objective. Human, not mother, nature often makes this happen with very large prospects but persist, large prospects can and will come in. It is this probability factor that needs most careful consideration. The geologist is forced to quantify his "ifs" and "buts".

Perceived geologic risk factors change with knowledge and risks will become lower as exploration proceeds. In the prime areas of the Cooper Basin this factor may be higher than 0.7. Erratic reservoir quality, inadequate mature source rock and possible flushing may reduce this factor to less than 0.2 in parts of the Eromanga Basin now being explored.

Given that everything works there may be one further risk, and this is that the reservoir is full of gas and not oil. This may be incorporated into the geologic factors (source, maturity etc.), or be treated separately depending mainly on the respective values of oil and gas.

There are commercial risk factors which cannot be ignored. The main one is "will the prospect or the area be drilled by the incumbent permit holder?" What's the value of Super Duper Oil N.L. which has one beaut permit about to expire but no money? The value of the permit to Super Duper, who do not seem to be able to achieve a farmout, is not much, but the value to someone else might be considerable. The value of Super Duper will depend mainly on their ability to achieve a farmout.

Similarly the ability of the operator cannot be ignored. There are other factors, for example a political risk, which may prevent the full potential of a permit being realized.

Having arrived at the risked value of the prospect the cost of finding it must now be deducted. This cost is not risked.

Figure 9

PROFITABILITY FACTORS

Prospect	Unrisked value ($M's)	Confirmation seismic	Seismic truth	Geology	Risked value	Exploration cost	Net value
					(millions of dollars)		
A	77	0.8	0.7	0.3	13	6	7
B	–	1.0	0.7	0.2	–	8	–
C	441	0.6	0.7	0.1	21	5	16
D	913	0.1	0.5	0.4	18	10	6

On the assumption that the operator will not drill those prospects where the risked value is less than the exploration cost then the sum of the positive figure gives the value of the recognised leads and prospects in a permit. Additional (proportional) value based on its geologic merits may be given for seismically unexplored areas.

Depending on the maturity of exploration over a permit and on the author's familiarity of the value of discovered oil (say from on stream projects), this method of permit valuation may be applied in lesser detail.

This type of analysis requires the normally reluctant geologist to quantify his opinions. To make full use of the work done, the results can easily be computer memorised and as knowledge of a company's permit increases and conditions change, a current value of a company's oil exploration permits can be kept.

By going through this exercise one can determine if farmouts, acquisitions or permit work commitments are reasonable. If the derived value is less than the cost to acquire the permit and participate in exploration, then a company should decline to participate. This may warrant a revision of the input numbers but if the value remains lower, there are no "ifs" and "buts", don't participate in the permit.

Should lack of time or knowledge prevent a full investigation of an area which may be acquired, some quick checks should be made. If, by the farmout method, a permit is calculated to have a certain value then some order of magnitude figures should be attempted. Try the formula "potential reserves X value of recoverable barrels of oil X risk less exploration costs equals real value". In a number of instances the potential reserves need to be outrageously high or the risks very low in order to get a value approaching the "farmout" value. The farmin should not be proceeded with.

The purpose of our modern geophysical, geochemical and geological exploration techniques is in the end to "contour the basin in dollars". By applying rational techniques geologists and analysts can come close to doing this.

THE FUTURE FOR INVESTMENT IN MINERALS

by

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1983/84 was another bleak year for Australia's minerals industry. Economic recovery did continue in most countries, but was heavily biased towards growth in the services sectors; real interest rates increased, international markets became more competitive and most metal and mineral prices faltered or fell.

The financial consequences of this uncertain economic environment for Australia's minerals industry are shown in the "Minerals Industry Survey 1984" conducted for the Australian Mining Industry Council by Chartered Accountants Coopers & Lybrand. The survey shows that while net profit for the industry increased in dollar terms from $381 million in 1982/83 to $461 million this year, this profit represented only a meagre 4.4 per cent return on average shareholders' funds.

On any measure of profitability — effective after tax return on average funds employed, effective after tax return on average assets — a profit of only $461 million is well below that which could be earned, *after tax*, on virtually risk free investments such as 10 year Commonwealth Bonds.

However, the aggregate data presented by the survey disguises the industry's patchy profit performance. Of the 150 companies responding to the 1984 survey 52 exploration and mining companies and 7 smelting and refining companies reported losses of $358 million. In the coal sector of the industry, which reported a net profit of $217 million last year compared with $193 million in 1983/84, 17 companies recorded losses totalling $100 million.

The survey shows the underlying reasons for the industry's poor performance in 1983/84, with the growth in costs paid continuing to outstrip the growth in prices received. Major areas of cost growth are in the industry's interest payments, and payments to governments for the use of services such as railways and ports.

Analysis of the industry's total revenue shows that in 1983/84 more than $2,400 million or 23 cents in every dollar of revenue was paid to governments in one form or another. This compares with $461 million, or 4.2 cents per revenue dollar, of net profit.

1983/84 was the third consecutive year of poor profitability, and with the first half of 1984/85 completed, there is little evidence to suggest that there will be a substantial improvement this year. This is taking its toll on future investment plans. Expenditure on fixed assets in 1983/84, at $2,049 million, was down almost $1,000 million in 1982/83. Survey respondents have forecast a further decline of 11 per cent to $1,824 million in 1984/85.

Looking to longer term sources of investment return, the mining industry has also drastically reduced its commitment to exploration with forecast expenditure in 1984/85 40 per cent below the amount spent in 1981/82, even *before* accounting for inflation.

In summary, while recent expansion in the industry's asset base holds the potential for future investment benefits, Australia's cost structure and high level of taxes means that the Australian minerals industry must await a more substantial recovery than is the case for other lower cost and lower taxed international competitors.