Mining investment – worth the risk?

Over the long term, mining has produced a rate of return less than the equity market in general, and certainly lower than industry expectations. In fact, the long-term performance of the industry seems to be about 3 per cent a year higher than the long-term return on a riskless class of assets, represented by long term-bond rates. Industry convention is that the required rate of return from a mining investment is at least 6 per cent, and up to 10 per cent, higher than expected bond rates. **Robert McDonald** *writes that since the industry is not generating such rates of return, and since providers of equity capital simply do not support unprofitable growth, it follows that industry conventions must be wrong.*

O ver the past 100 years the Australian mining industry has grown by 6.5 per cent a year, or 2.6 per cent annually in real terms — approximately the same growth rate as experienced by the economy as a whole (ABARE 1992). As a percentage of gross domestic product, mining, as high as 16 per cent in 1860, fell to 5 per cent in 1880, doubled to 10 per cent by 1900, and then through to 1960 declined in relative importance to 2 per cent.

Since the 1960s Australia has had enormous growth in its mining activities through major investments in iron ore, aluminium, oil and gas, and coal. This rapid growth was maintained in the 1970s (Table 1).

The mining industry today is more than eight times its size in 1960 and it represents around 6 per cent of the Australian GDP, directly employing a little over 1 per cent of the workforce. These statistics may fail to indicate adequately the importance of mining to the Australian economy: in fact, mining provides between 40 and 50 per cent of Australia's exports, up from less than 10 per cent in 1960, and each job in the mining industry indirectly supports between one and two jobs elsewhere (Clements 1991).

Funding growth of the mining industry

Before the 1960s the capital requirements of the Australian mining industry were relatively modest. Mines

on which the Australian mining industry was built,[1] such as Broken Hill (floated 1885), Mt Morgan (1886), Mt Lyell (1893), Sons of Gwalia (1898) and Mount Isa (1925), raised barely any capital at the time of their public listing; listing appeared to be more a way of providing liquidity to members of the initial funding syndicate.

Although there may not have been a need for substantial capital, even 100 years ago there was nevertheless a very active mining equity market. For example, during the Western Australian gold boom of the 1890s some £70 million ($A6 billion in 1992 terms) of equity was raised, mainly in the UK — of which only about 10 per cent arrived in the colony to fund investment! (Adamson 1989.)

The industry has, however, become a prodigious user of capital (Table 2). Real-term capital expenditure on mining jumped from $A500 million a year in the early 1960s to $3.25 billion in 1970 and $4.75 billion in 1972. More than $90 billion (real terms) has been invested in the Australian mining industry since 1960, about $1 million per employee. This capital intensity first creates, but also requires, high labour productivity.

Additionally, over the past 30 years more than $15 billion (1992 terms) has been invested in exploration.

In the 1960s, Australian institutional investors were not an important factor in the provision of local equity. It is difficult to think of any major

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Australian resource development during this period that did not involve significant foreign investment.

During the 1980s the Australian mining industry had a sources and application of cash of some $A80 billion (McDonald 1993), of which about half was internally generated from operations, 40 per cent from borrowings, and 10 per cent from new equity. The $8 billion of new equity raised by the mining industry was about 10 per cent of all equity raisings in the Australian stockmarket. Over this same period a number of foreign companies floated their local subsidiaries in Australia. For example, in 1986/87 Homestake raised $230 million, Newmont $315 million, and Placer $169 million from the Australian market.

The industry's capital structure has changed over the 1980s. The capital structure has been estimated using debt-equity ratios, defined as the book value of long-term debt (assumed to be the same as market value of long-term debt) divided by the company's average market capitalisation during the year in question. Average debt-equity ratios for a series of four-year periods starting in 1983, for a sample of major Australian companies and a sample of international groups, are shown in Table 3.

This reduction was more to do with the increase in equity values rather than a reduction of debt.

Worth of the mining industry

It is estimated that the mining industry — including an allowance for non-listed investments — has a market capitalisation of some $50 billion, about 30 per cent of the total market. (Internationally, mining accounts for less than 2 per cent of the worldwide equity market.) The value of the underlying businesses is greater than their equity valuation by the level of debt. With a debt equity ratio of, say, 0.25, the value of the underlying mining assets is $62 billion (Table 4).

Since starting to diversify internationally in the 1980s, Australia has become an increasingly important part of the international mining industry. Already CRA has built up an important presence in Indonesia, BHP in Chile, WMC in North America and MIM in Europe and Canada. It is likely that the major Australia companies will continue to diversify both

Table 1: Real term growth rates (% per annum)

	Mining	Total economy
1960-70	13	5
1970-80	8	4
1980-90	6	4
1960-90	8	4

Source: Gross product statistics in 1985/84 prices. Commodity Statistical Bulletin 1991, ABARE (numbers have been rounded).

downstream and abroad. Associated with this diversification will be a growing transfer of capital offshore, particularly in the Pacific Rim and South-East Asia.

Past performance

In an efficient and sophisticated capital market it is generally recognised that assets are priced so as to offer an adequate return, both by capital appreciation and dividends, to the providers of equity capital. If the expected rate of return is inadequate there is almost an instantaneous adjustment by, for example, a reduction in share prices so as to ensure that expected rates of return do actually conform with required rates of return. Similarly, if assets are generating more than an appropriate rate of return, the value of the asset will be priced up so that its expected yield equates to the cost of capital. In gauging the required rate of return on a mining asset it may be sufficient to investigate the actual

Table 2: Mining Capital Expenditure (real terms, 1992 $A)

	$A Billion
1960-1970	14
1970-1980	28
1980-1990	45

Source: ABARE 1991, adjusted for inflation

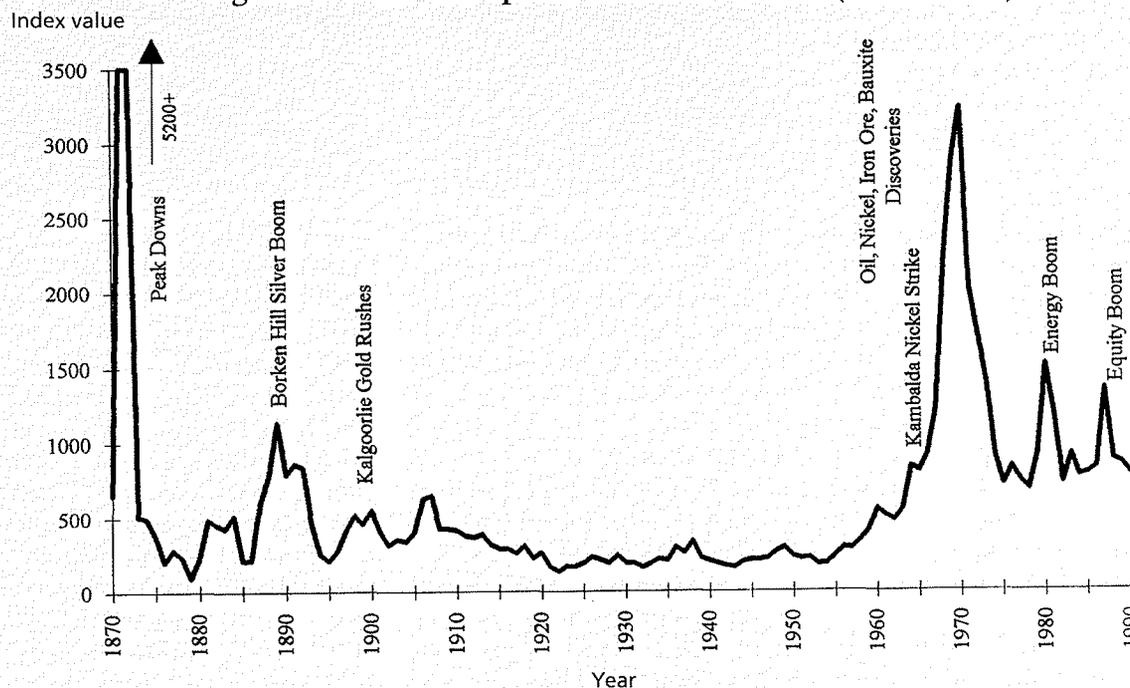rate of return over a long period of time.

During the period 1970 to 1990 the Australian mining industry offered a return to providers of equity capital — both capital appreciation and dividends, which are assumed to have been reinvested — of 8.2 per cent a year in nominal terms, or minus 1.2 per cent in real terms. Of course, some companies outperformed others. For example, the best performer from the portfolio produced a twenty-year real rate of return of 4.7 per cent a year, and the worst minus 5.7 per cent. The calculation of these rates of return assumes that an investor purchased a portfolio of major Australian mining stocks[2] in December 1970 and held the portfolio until December 1990.

Rather than measure rates of return by assuming a passive twenty-year holding period, particularly when the start-year of 1970 was at the height of the Poseidon boom, it is likely to be more appropriate to attempt to measure rates of return between the same two points of successive cycles (ie, peak-to-peak or trough-to-trough). Assuming a five-year cycle and with it a five-year holding period,[3] the average annual real rate of return for investors from this portfolio, over the period December 1970 to July 1992, was closer to 5.5 per cent. This rate of return was calculated by averaging the rate of return for each five-year period on a monthly basis (that is, January 1971 to January 1976, February 1971 to February 1976, and so on). The standard deviation was 8.8 per cent.

What about an extended period to get around the need to account for cycles? Figure 1 is a share-price index provided by the Australian Stock Exchange (ASX), converted into a real-term (1992) index. The price index gives a measure of how the value of mining assets fluctuates over time. Worthy milestones are:

1872: Peak Downs copper strike, then collapse of copper prices.

Table 3: Debt-equity ratios* for various periods, 1983-91

	Australian majors	International majors
1983-1986	0.46	0.38
1984-1987	0.45	0.36
1985-1988	0.41	0.33
1986-1989	0.33	0.31
1987-1990	0.25	0.27
1988-1991	0.24	0.28

*Long-term debt to market value of equity.

Figure 1: Real-term price index since 1870 (1992 terms)

1880: Tin discoveries.
1888: Broken Hill silver boom.
1895: Kalgoorlie/Coolgardie gold rushes.
1907: Copper price increase.
1922: Copper price collapse.
1936: Western Australian mini gold boom.
1960s: Nickel, iron ore, alumina discoveries.
1974: First oil shock.
1980: Energy boom, coal and uranium.
1984-1987: Equity boom and gold mining boom.

Interestingly, no boom was able to match that of 1965-70 except the Peak Downs copper strike in the 1870s. The surge in asset values in the 1965-1970 period was based in part on both discovery and confirmation of development potential; nickel, iron ore, bauxite, oil and gas featured prominently during this period. At the time of its Kambalda nickel discovery in 1966, WMC was capitalised at $20 million ($140 million, 1992 terms). One year later, its market value had increased 12 times. The value of Hamersley Iron increased fourfold within a year of its float in 1967 (Adamson 1989).

The rate of growth of this index is the same as the industry's rate of return assuming that there has been no leakage through dividends. Over 100 years (July 1892 to July 1992), this

Table 4: Value of the Australian mining industry, 1991

	$A billion
Value of ASX Gold Index	7
Value of ASX Other Metals Index	21
Value of ASX Solid Fuels Index	2
Value of ASX Diversified Resources	2
Value of 1/3 BHP	7
Value of other listed mining assets	1
Value of non-listed mining assets*	10
Value of equity	**50**
Value of debt	12
Value of underlying business	**62**

Source: ASX, estimates by the author.
*Non-listed mining investments include direct foreign investment in such things as the Robe River iron ore project (47 per cent) and Darling Range bauxite/alumina operations (51 per cent).

index has grown at a nominal term rate of 4.7 per cent a year or, after allowing for a 100-year inflation rate of 3.8 per cent a year, 0.9 per cent in real terms. Of course, dividends were paid out by the industry, offering the providers of equity capital a further source of return. Dividend information specific to the Australian mining industry over the past 100 years is difficult to obtain; however, information is readily available on industry dividend yields since 1980. Since then, dividend yields[+] for the mining industry have averaged around 2.9 per cent a year (Table 5), compared with 6.5 per cent for Australian industrial stocks.

Interestingly, for the period Janu-

Table 5: Average dividend yields (ASX Mining Index)

	% p.a.
1980	2.92
1981	2.46
1982	1.78
1983	2.31
1984	1.67
1985	2.52
1986	3.52
1987	3.64
1988	2.08
1989	4.85
1990	4.22
1991	4.23
1992	2.34

ary 1980 to the time of the stockmarket correction in October 1987, mining dividend yields averaged 2.4 per cent a year. Since then (to June 1992), the annual average has been 3.8 per cent.

It is considered reasonable to take this 1980-1992 experience as a guide to yields over the very long term.[5] This suggests that annual real rates of return enjoyed by providers of equity capital to the Australian mining industry over the past 100 years has been in the 3 to 5 per cent range (Table 6).[6]

Are returns adequate?

Officer and Hathaway (1992) have calculated over a somewhat longer period, 1882 to 1991, that the real rate of return (capital appreciation and dividends) from the Australian share-market has averaged around 8 per cent a year. It would appear therefore that mining stocks have offered a long-run return lower than industrials. Officer and Hathaway also calculate that real-term bond rates since 1882 have averaged around 2.1 per cent, meaning that an average equity investment has produced a rate of return of 6 per cent more than bonds, while a mining investment has offered only a 3 per cent premium.

Investors are risk-averse and therefore require to be compensated — through higher expected rates of return — for taking on risky investments. If risk is the same as volatility as measured by, for example, the standard deviation of annual returns, then we can show that mining is riskier than bonds.

Since 1891, the standard deviation of mining returns (price movements only) has been 24.7 per cent, compared with 8.1 per cent for bonds and (since 1928) 19.5 per cent for all equities. It is tempting to conclude that a mining investment has not generated a return commensurate with risk, a conclusion reached previously by Ball and Brown (1979).

However, the level of sharemarket activity (equity raisings and turnover) indicates that the industry has ready support from the equity market.[7] This support would have disappeared if resource assets were continually trading in excess of fair value or, said another way, if rates of return from the industry are insufficient to compensate investors for risk, as seems to be the case for the mining industry.

Table 6: Real rates of return, Australian mining industry 1892-1992

Real price growth, say	1% per annum
Dividend yields, say	2-4% per annum
Real rate of return, say	3-5% per annum

An important observation related to the role of an international investor[8] helps to explain why mining asset values have not fallen to levels sufficient to generate apparently appropriate rates of return.

Risk to whom?

Risk in a capital-market sense is not really absolute volatility but the additional volatility that a new investment would bring to an already well diversified portfolio. Some assets can be very volatile but if they are negatively correlated with a diversified portfolio they actually reduce risk without reducing returns.

Take, for example, gold, which over centuries has been considered a hedge, although in more recent times its hedging characteristics have come into question. Now, a hedge is really an investment that tends to move in a different direction to a particular portfolio thus reducing overall portfolio volatility. So although gold's price may be volatile, its hedging characteristics mean that it can at the same time be considered a low-risk asset. To an international investor, Australia represents a diversification opportunity, given that one-third of the capitalisation of sharemarket is made up of mining stocks, compared with about 2 per cent internationally.

At present some 25 per cent[9] of trading in Australian equities is conducted in offshore markets. Further evidence suggests that foreign investors hold 20 per cent of Australian listed equities compared with 60 per cent by local institutions and 20 per cent by private investors. Anecdotal evidence indicates that, among the mining stocks, much of the price setting activity at the margin is being undertaken by the foreign investor. During the 1980s a number of Australian listed companies sought quotation on overseas sharemarkets to facilitate capital raisings in the implicit recognition by management that they can alter a company's cost of equity capital and, in so doing, possibly increase asset values.

With the freeing of the currency and financial markets in Australia during the 1980s and the explosion of information, Australia is now recognised as being but a small part — around 1.5 per cent — of the international capital market.

The riskiness of a resources investment therefore needs to be considered in the context of an internationally diversified portfolio. Against an internationally diversified portfolio such as the Morgan Stanley Capital Index (MSCI), an Australian resources investment is shown to be significantly less risky than when measured against a portfolio of Australian assets only. The cost of equity capital for an Australian-based resources company can therefore be lowered if the company's marginal investor happens to be a foreign investor.[10]

Required returns

Since the 1970s the Capital Asset Pricing Model (CAPM) has been commonly used by the mining industry to determine the industry's cost of equity capital. The CAPM[11] relates required rates of return to risk, where the risk of an investment is measured as the additional variability that an investment would contribute to a well diversified portfolio of investments normally held by the providers of equity capital.

The relevant measure of risk, known as beta (ß), is the expected co-variance of returns from the investment to the return from a diversified portfolio represented by the market index. The general form of the CAPM is appropriate for appraising post-corporate pre-personal tax cashflows, as is conventionally applied in capital budgeting exercises, only if the personal tax rate on interest income is identical to that on equity returns, or the shareholder is a non-taxpayer.

The general CAPM formula[12] is expressed as:

$$R = R_f + ß (R_m - R_f)$$

where R is the required rate of return to providers of capital;

R_f is the risk-free rate

of return, such as a long-term government bond;

β is the measure of relative risk;

R_m average rate of return of a well diversified portfolio.

Over the past 100 years or so, since 1882, Australian ten-year bond rates have averaged 5.5 per cent a year in nominal terms against average annual inflation rates of 3.3 per cent,[13] meaning *real bond rates* (R_f) more or less, of 2.1 per cent.

Over the long term the average equity premium over a low-risk bond, R_m - R_f has averaged 6 per cent[14] a year in most economies, including Australia.

The risk of Australian mining equities to an international investor has been estimated with a well diversified portfolio represented by the MSCI World Index. In general, the statistical methodology used to calculate betas is Ordinary Least Squares, that is, the slope of the regression of the natural log of returns, over a particular period, between the mining index and the market index, MSCI. The observed β for a portfolio of major Australian companies for the four years to 1991 was 0.53; for the ASX All Mining Index it was 0.38. After adjusting the β estimates for capital structure, the ungeared β estimates became 0.46 and 0.33 respectively.

Assuming that the relative risk of mining is the same today as over the last century, long-term real bond rates of 2 per cent a year and $(R_m$ - $R_f)$ of 6 per cent, theory suggests that the required rate of return over the past 100 years to an international investor from an Australian mining investment would have been around 5 per cent a year, similar to the actual rate of return observed.

Conclusion

Over the very long term, mining investors have priced Australian mining assets to offer a real-term yield of 5 per cent a year. The real-term cost of capital from international investors for Australian mining investments has also been around 5 per cent a year.

Why has the industry continued to use discount rates of 10-15 per cent a year on after-corporate-tax cashflows for capital budgeting purposes? This seems to have ignored the role of the foreign investor in determining asset values, and possibly indicates a confu-

sion between risk to shareholders and risk to mining company executives.

Looking forward, it is clear that the market expects real long-term bond rates to be higher than the 2.1 per cent a year experienced over the past 100 years, and probably around 4 per cent. It would seem therefore that expected annual returns from new mining investments today are around 7 per cent in real terms. ∎

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NOTES

1. After 100 years, Mt Lyell continues in operation, producing around 20,000 tpa of contained copper in concentrate, as does Broken Hill, currently producing 220,000tpa of zinc, 140,000tpa of lead and 136tpa of silver in concentrate. Broken Hill spawned several major Australian companies in addition to BHP Limited, including CRA Limited and North Broken Hill Peko Ltd, which merged their interests at Broken Hill as part of the formation of Pasminco Ltd in 1988. Mt Morgan, over 99 years of operation, yielded 7.5 million ounces of gold and 360,000t of copper (with further gold production from tailings retreatment). Sons of Gwalia operated until 1963 to produce 2.6 million ounces of gold; operations were restarted in the mid-1980s, producing a further 0.5 million ounces of gold.
2. The portfolio is made up of Aberfoyle, Coal & Allied, CRA, MIM, NBHP, WMC.
3. Different holding periods produce different returns, eg:

Holding period	Real rate of return%	Standard deviation %
12 months	7.2	38.1
24 months	4.7	21.8
36 months	4.5	14.9
48 months	4.8	9.9
60 months	5.5	8.8

4. Dividend payments divided by market capitalisation.
5. Conventional wisdom is that dividend yields in the past have been higher than those experienced in the 1980s. We have not been able to confirm this directly, but we note that in 1980 BHP was offering a dividend yield of 8-9 per cent, increasing to around 15 per cent at the time of the market collapse in late 1982.
6. Over the past 50 years (1942-1992), again assuming a 3 per cent dividend yield, the Australian mining industry has offered an investor a real rate of return of 5-7 per cent a year with a correspondingly lower return for the 50 years up to 1942.
7. During the 1980s the mining industry invested more than $40 billion (1990 terms) and paid out dividends of $10 billion. Funding was from operational cashflow and new equity raisings.
8. The Australian mining industry was built on foreign capital. Most major Australian

miners have a foreign company as their dominant shareholder.
9. As high as 40 per cent (ASX Annual Report, 1990).
10. For convenience, this paper does not address the impact of dividend imputation, where after 1987 Australian investors, unlike foreign investors, received a credit for Australian corporate tax paid.
11. Recent work by Fama and French (1992) has raised questions about the predictive power of the CAPM model.
12. The model is somewhat more complicated when extended to allow for taxes and different tax rates on debt and equity returns.
13. This inflation rate is lower than reported earlier because of a longer time-span. During 1882-1892, inflation rates were negative at minus 1.04 per cent a year.
14. For example, Ball and Bowers, 1986, "Shares, Bonds, Treasury Notes, Property Trusts and Inflation: Historical Returns and Risks", *Australian Journal of Management*, December; and for US data, Ibbotson and Singuefield, 1982, "Stocks, Bonds, Bills and Inflation", the Financial Analysis Research Foundation.

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