

Creating a Diversified Mining Share Investment Portfolio based on Trading Comparables and Valuation Indicators

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Abstract

Models have been developed to determine the interrelationship between technical and financial risk in mineral projects. These integrate an understanding of geology, mining, processing and sources of capital to improve the speed at which potential projects might be assessed and financed. This includes an analysis of how chances of success could be enhanced through an improved integration of financial and technical appraisal. Models are based on case studies that include the following valuations:

- Single Operation Companies
- Multiple Operation Copper Mining Company
- Multiple Operation Polymetallic (Ni-Cu-Precious Metal and Zn) Mining Company
- Single Operation Gold Mining Company
- Multiple Operation Gold Mining Company

The groupings also incorporate several categories based on the value of total assets. These are the Global giants (USD above 12 billion), Seniors (USD 6 – 12 billion), Intermediates (USD 3 – 6 billion) and Production juniors (USD 1 – 3 billion). Case studies consider the full range of these categories with market capitalisation being used as a proxy for total assets.

Key valuation metrics include the following:

- Share Price/Net Asset Value
- Enterprise Value/Net Present Value (Key Metric)
- Enterprise Value/EBITDA

Share Price/Net Asset Value and Enterprise Value/ Net Asset Value are in turn are a function of Net Present Value (NPV). This requires an appraisal of the technical and financial variables needed to generate a discounted cash flow model. The utility of the ratios lies in demonstrating the interrelationship between share performance metrics of listed companies with mineral assets and the financial models of the underlying mining operations or projects. They are particularly useful metrics as they integrate share performance indicators with a Discounted Cash Flow (DCF) model that provides a benchmark for a valuation of the company.

Based on share performance metrics, the cases studies cover the full spectrum of possible Trading Comparables and Valuation indicators which is indicative of a diversified mining share portfolio.

Consideration is given to the mechanisms that apply when fresh equity is raised to develop a new project through a rights issue. Markets should recognise future benefit of project development and therefore acting as a driver in increasing share price and the overall stakeholding would then be accretive. This links through to the merits of using cash to enhance dividends thereby maintaining credibility with fund managers when seeking to raise fresh equity.

In seeking to enhance the value of a projects, financial modelling can consider bringing in a debt component which would allow discounting by WACC; That should both enhance NPV and reduce the amount of equity needed for an Initial Public Offering (IPO) which in turn means a higher valuation for promoters and less dilution of their pre-IPO stake holding.

The comparative analysis of mining valuation metrics highlights the significant influence of operational scale, commodity type, and perceived risk on share performance. Multiple-operation companies consistently achieve higher valuations due to diversification benefits, while single-asset producers often trade at discounts reflecting greater operational vulnerability.

Gold producers command the highest valuation multiples because of strong investor demand and the strategic role of gold as a financial asset. In contrast, copper and polymetallic producers typically trade closer to intrinsic asset value or at modest discounts due to commodity price cyclicity and operational complexity.

Introduction

Valuations of public companies are derived from a range of share performance metrics. These include the following:

- Basic Market Capitalisation = Basic Shares Outstanding x Share Price.
- Fully Diluted (FD) Market Capitalisation = Fully Diluted Shares Outstanding x Share Price.
- Fully Diluted Shares Outstanding = Basic Shares Outstanding + ITM Options.
- In-the-Money (ITM) Options = Number of Options where Strike Price < Share Price.
- Enterprise Value (EV) = Market Capitalisation + Debt – Cash & Cash Equivalents – Investments. The minimum amount needed if the company was an acquisition target.
- Net Asset Value (NAV) = Net Present Value (NPV) – Debt + Cash + Investments. Intrinsic worth of the company. A benchmark if the company was an acquisition target.
- EBITDA = Earnings Before Interest, Taxes, Depreciation, and Amortisation. After taxation used to provide a dividend stream.

In a recent paper (Buchanan, 2025b) case studies were developed for single project ownership based on copper, nickel and platinum-group elements operations. For these case studies the two key metrics in financial reporting used were Share Price/Net Asset Value and Enterprise Value/ Net Asset Value which in turn are a function of NPV. This requires an appraisal of the technical and financial variables needed to generate a Discounted Cash Flow (DCF) model.

NAV model assumes that the company does not increase its existing reserves, so when these assets are depleted, there's no value left. The role of reserves and resources in determining the value of a company is treated in the paper by Gillis, et al (2023). The book value of a company's assets may be entirely out of line with its mineral asset value because of standard accounting practices' backward-looking nature. The geological potential of extensions to mineralisation included in the reported reserves and resources could, however, be assumed in a DCF model to determine NPV. Any insight by an analyst into the technical aspects of an operation, such as the disclosure of a large, inferred resource with evaluation drilling could be converted into an indicate resource, could significantly enhance the NPV and therefore the valuation. Clearly extracting this information from company disclosures is a non-trivial task and requires an appreciation of grade and tonnage of the resource, the mining and processing methods and associated operating costs, capital estimates if extensions of mine life or expansion of rates of production are planned.

As a first pass the NPV should be generated at the pre-feasibility and pre-funding stage based on a fixed discount rate using current spot metal price assumptions.

Actual investment decisions would incorporate a source of capital based on an accounting model and optimisation of the balance of debt and equity and consideration of standard performance indicators to determine if there is sufficient cash to meet loan conditions. This is in turn constrained by hedging requirements. The use of project finance could be considered as this protects the borrower's overall balance sheet as the repayment to the lender is restricted to cashflow generated by the project (Buchanan, 2025a and Cunningham, 2025).

Clearly this vastly increases the complexity of the financial models and for initial valuation of a mining company listed on a stock exchange this is probably over-engineering the task without increasing the level of confidence needed to determine if the company is fairly valued based on metrics that incorporate NPV.

An alternative approach to extracting all the technical variables and applying cost and metal price assumption that are needed for a formal DCF model, is to use the Free Cash Flow Forecast (FCFF) with the initial amount derived from the most recent financial accounts. An assumption can be made on a growth rate and a terminal period selected. The resulting values for each period would be discounted to generate a present value. This will obviously involve an oversimplification of the modelling but will probably suffice as a first approximation.

An additional key performance indicator is:

- Enterprise Value/EBITDA

This could be linked to a DCF model albeit EBITDA would be provided in current financial accounts. Interpretation and implications of these ratios is given in Table 1.

Share Performance Metrics – Table 1.

Ratio	Range	Interpretation and Implication
Share Price/Earnings (Trading Comparable)	20 - 25 is good, the lower the better	Basic and useful valuation metric. A low share price compared to earnings, therefore a low ratio, suggests expectation of high growth potential. Does not consider the amount of debt carried by the company. Enterprise Value/EBITDA is an alternative metric that does consider debt
Share Price/Net Asset Value (Valuation)	<1.0	Trading at a discount to NAV. Often in undervalued funds, distressed assets, or cyclical downturns
	=1.0	Trading at par with NAV. Fairly valued.
	>1.0	Trading at a premium to NAV Seen when investors expect strong growth, superior management, or hidden asset value. Suggests that the shares are undervalued.
Enterprise Value/Net Present Value (Valuation) Key Metric	<1.0	Possibly undervalued and an acquisition opportunity
	=1.0	Market value $\approx$ intrinsic value. Fairly valued. Minimum amount needed for an acquisition bid based on a DCF model.
	>1.0	Possibly overvalued or trading at a strategic premium
Enterprise Value/EBITDA (Valuation)	The range for the mining industry normally lies between a ratio of 6 to 8	A ratio of 10 means that undiscounted annual earnings multiplied by 10 would generate an income approaching the market capitalisation. A higher value could be indicative of a long-life quality project. This is a common metric used to compare miners, (Dempsey, 2024).
P/NAV, EV/NPV, EV/EBITDA		These ratios are particularly useful as they integrate share performance indicators with a DCF model that provides a benchmark for a valuation of the company.

In seeking to enhance the value of a project we can consider bringing in the role of the debt component which would allow discounting by WACC; That should both enhance NPV and reduce the amount of equity needed for an Initial Public Offering (IPO) which in turn means a higher valuation for promoters and less dilution of their pre-IPO stake holding.

In the real world this is a major consideration.

There is a separate narrative around a rights issue to meet the final capital cost after the project has secured, say, 30% debt. A rights issue linked to project development will result in further dilution.

If the market perceives that the project is high risk, then it becomes more expensive to issue equity. A low share price means more shares will need to be sold to raise the same amount of money, diluting existing shareholders more and potentially sending the share price even lower.

The debt market would be no more hospitable. It also becomes more expensive to issue debt for high-risk projects.

Accounting impairment needs to be considered where the market value of an asset declines. There are numerous examples of mining companies having to report impairment on previous acquisitions emphasising the role of robust valuation methodologies in new business development. In their paper (Gillis, et al, 2023) showed that commodity prices were the dominant factor in annual

shareholder return in most of the mining companies included in their review, while over the long term it was mineral asset impairment that has a much greater impact.

In this paper five case studies are considered, the first of which is single project ownership based on copper taken from Buchanan (op. cit.) three incorporate multiple projects split between part ownership and complete ownership. The fifth is again a single project ownership but considered within the context of a takeover. There is also reference to the rights issue outlined in Buchanan (op. cit.). All the case studies are incorporated in the edumine On-Demand/e-Learning course (Buchanan, 2025c) that examines how share performance metrics of listed companies can be integrated with DCF models of underlying operations or projects to provide a holistic valuation. The courses emphasizes that valuing mineral assets is an art as a much as a science, requiring imagination and interpretation – particularly in acquisition scenarios aligned with strategic business goals.

The models can be applied to determine the interrelationship between technical and financial risk in mineral projects. These would integrate an understanding of geology, mining, processing and sources of capital to improve the speed at which potential projects might be assessed and financed. This would include an analysis of how chances of success could be enhanced through an improved integration of financial and technical appraisal.

In their paper Hodge, et al (2022) have assigned the global mining industry into several categories. Based on the value of total assets these are the Global giants (USD above 12 billion), Seniors (USD 6 – 12 billion), Intermediates (USD 3 – 6 billion) and Production juniors (USD 1 – 3 billion). The case studies in this paper considers the full range of these categories with market capitalisation being used as a proxy for total assets.

Rights Issues and Share Buyback

There is a link to pricing a rights issue to ensure it is accretive and not dilutive to existing shareholders. The formula for the Theoretical Ex-Rights price (TERP) is as follows:

$$\text{TERP} = (\text{No. of existing shares} \times \text{Price/Share}) + \text{No. of new shares} \times \text{Rights issue Price} / \text{Total No. of shares after rights issue}$$

The application of this approach compared to likely market response is outlined in the nickel laterite case study Buchanan (op. cit.) where it is shown that a with a successful rights issue the outcome will be dilutive with respect to the original shareholding but accretive with respect to the value of the holding. The following variables were used in the case study.

$$((190 \text{ million} \times \$1.14) + (78 \text{ million} \times \$0.90)) / 268 \text{ million} = \$1.07$$

This is the theoretical' worth of a single share of a company immediately after a rights issue with no uplift in share price. Although dilutive for shareholders the share price post raising was \$1.77 reflecting the confidence the market placed on the merits of the technical advantages that would flow. The utility of apply the TERP formula would be in setting a floor to price of the rights issue. These concepts are summarised in Table 2

Theoretical Ex-Rights Price (TERP) – Table 2

Description		Comment	
Shareholding at 2021	100,000	0.0526%	
Value pre rights issue	\$114,000		
Shareholding at 31 Dec 2022	110,000	0.0411%	Dilution of with respect to the original shareholding
cost	\$9,000		
Value post rights issue	\$194,700		
Net gain	\$71,700		Accretion with respect to the value of the holding

In implementing a share buyback and retiring stock the company ensures that future income is divided among a smaller number of stakeholders. With share buyback for the same share price and greater earnings the P/E ratio falls so with good technical fundamentals the share price should rise. It is, however, also likely to flag an absence of investment opportunities. Stakeholders retaining their shares should see a rise in the share price and therefore an increase in the value of their holding.

The corollary of share buyback occurs when fresh equity is raised to develop a new project through a rights issue. Markets should recognise future benefit of project development and driving an increase in share price and the overall stakeholding would be accretive. This links through to the merits of using cash to enhance dividends thereby maintaining credibility with fund managers when seeking to raise fresh equity.

This thread is picked up in the paper.

Case Studies

Case Studies - Valuation of Single Operation Companies (Intermediate and Production Junior)

In the case study of a single project Copper company Buchanan (2025b) a discounted cash flow model was produced based on an *in situ* resource of 189 million tonnes of copper ore grading 0.5% with a stripping ratio of ore:waste of 1:1.8, mining recovery of 90%, dilution of 10% and plant recovery of 90%.

Production of ore was 15.43 million tonnes/annum giving a 11year project life. Costs included sustaining capital of \$20 million per annum over the first five years with an overall operating cost of \$374 million per annum.

At a copper price of \$8,500/tonne and a tax rate of 12.5% an NPV of \$844.08 million was generated based on a discount rate of 10%. Earnings before interest, taxes, depreciation, and amortization (EBITDA) were \$154.13 million per annum.

The share performance metrics are given in Table 3.

Share Performance Metrics for a Single Operation Copper Mine – Table 3.

	Description	Variable	USD	Indicator
Trading Comparables	Share Price		\$4.24	
	Earnings/share (2022)		\$0.24	
	Market Capitalization (Millions)		\$595	
	Fully Diluted Share Outstanding (Millions)	140.42		
	Price/Earnings. 20-25 is good, the lower the better.			17.61
Capitalisation	Market Capitalisation		\$595	
	Debt (millions)		\$77.00	
	Enterprise Value (Millions). Market Capitalisation + Debt - Cash - Investments. The minimum amount needed if the company was an acquisition target.			\$672.63
	Copper Price \$/tonne	\$8,500		
	NPV (DR 10%) (Millions)		\$844	
	Debt (Millions)		\$77	
	Net Asset Value (Millions). NPV - Debt + Cash + Investments. Intrinsic worth of the company. A bench mark if the company was an acquisition target.			\$774.08
	NAV/Share (\$/share)		\$5.51	
Valuation	P/NAV (Share Price/NAV) Share Price/Net Asset Value. A ratio below 1 is a good multiple since it suggests that the shares are undervalued.			0.77
	EV/NPV. A ratio of one means that the discounted cash flows confirm the minimum amount needed for a bid if the company was an acquisition target. Less than one means there is good upside potential.			0.80
	EBITDA (Millions) per annum. After taxation used to provide a dividend stream and can be used for share buyback.		\$154	
	EV/EBITDA. A ratio of 10 means that undiscounted annual earnings multiplied by 10 would generate an income approaching the market capitalisation. A higher value could be indicative of a long-life quality project.			4.36

The EV/EBITDA range for the mining industry normally lies between a ratio of 6 to 8 so for this case study the project is potentially undervalued.

Case Studies - Valuation of a Multiple Operation Copper Mining Company (Global Giant)

Introduction

For a holding company with multiple separate operations based on different deposits and geographically diversified the task of generating a valuation becomes more complex. In this case study a possible approach is used to reconcile technical factors with share performance. The assumption is that the operating company owns several mining operations based on copper deposits that also generates significant credits from gold as a by-product. The ownership holding, reserve, grade, production and mine life of the scenario is outlined in Table 4

Multiple Projects Split between Part Ownership – Table 4

Joint Venture Operation	Ownership	Reserve Mt	Cu %	Cu Prodn tpa	Ore Prodn tonnes Mtpa	Mine Life years
A	70%	727	0.31	77,800	36	20
B	70%	1,900	0.40	242,000	53	36
C	50%	353	0.42	40,500	36	12
D	60%	845	0.58	300,000	36	11
Total		3,825	0.43	660,300	161	

The strategy is to sell concentrate into the market under an offtake agreement rather than to enter into a hedging programme normally required when securing project finance.

A discounted cash flow economic model for project B was produced based on an *in situ* resource of 1,900 million tonnes of copper ore grading 0.41% and 0.21 grams per tonne of gold with a stripping ratio of ore:waste of 1:3, mining recovery of 90%, no dilution and plant recovery of 83%.

Production of ore was 53 million tonnes/annum giving a 32-year project life. Costs included sustaining capital of \$20 million per annum over the first five years with an overall operating cost of \$1,115 million per annum.

At a copper price of \$8,500/tonne and a tax rate of 27% and a discount rate of 10% an NPV of \$7,643 million was generated. At a discount rate of 8% an NPV of \$9,248 million was generated. Earnings before interest, taxes, depreciation, and amortization (EBITDA) were \$2,256 million per annum.

NPV of estimated future cash flows expected to arise from its continuing use of mining infrastructure. Based on sustaining capital only and assumed sunk capital for development

Treatment of Non-controlling Interest

The assumption is that the operating company has control (typically >50% ownership) though subsidiaries and those operations are fully consolidated in the financial statements. This means that 100% of revenues, costs, assets, and liabilities of the subsidiary are included. However, the portion not owned by the operating company is treated as a "non-controlling interest" (NCI) in the income statement and balance sheet.

Example: If the operating company owns 60% of an operating mine, 100% of that mine's results are shown in the group accounts, but 40% of profit is allocated to NCI.

Valuation Metrics

Valuation metrics require NPV based on technical and financial variables for the operations controlled by the Company. EBITDA is derived from the cash flow model.

For Operation B the NPV has been adjusted based on the ownership and the value of contained copper in the reserve which is 37% and scaled if the other three operations have proportionately comparable NPVs. Clearly a DCF model should be generated for each of the other three operations, but this offers a short cut. This generates an NPV of \$20,854 million using a discount rate of 10%. This then needs to be integrated with the share performance metrics. The share performance metrics are shown in Tables 5, 6 and 7.

Share Performance Metrics of a Multiple Operation Copper Mining Company - Trading Comparables – Table 5

Description	Variable	USD	Indicator
Share Price		\$20.72	
Earnings/share		\$1.2833	
Market Capitalization (Billions)		\$20.154	
Fully Diluted Shares Outstanding (Millions)	985.96		
Price/Earnings. 20-25 is good, the lower the better. A low price compared to earnings suggests doubt about viability			21.32
Dividend		\$0.32	

Share Performance Metrics of a Multiple Operation Copper Mining Company - Capitalisation – Table 6

Description	USD	Indicator
Market Capitalisation (Millions)	\$20.154	
Debt (Loans) (Millions)	\$1,630	
Primarily due to investments in major projects.		
Enterprise Value (Millions). Market Capitalisation + Debt - Cash - Investments. The minimum amount needed if the company was an acquisition target.		\$21,784
NPV (DR 10%) Millions. NPV for operation B assuming the operation represents 37% of the value of the company.	\$20,854	
Net Asset Value (NAV) Millions. NPV - Debt + Cash + Investments. Intrinsic worth of the company. A bench mark if the company was an acquisition target.	\$19,224	
NAV/Share (\$/share)		\$19.50

Share Performance Metrics of a Multiple Operation Copper Mining Company - Valuation – Table 7

Description	USD	Indicator
P/NAV (Share Price/NAV). Share Price/Net Asset Value. A ratio below 1 is a good multiple since it suggests that the shares are undervalued.		1.06 (10% DR) 0.87% (8% DR)
EV/NPV. A ratio of one means that the discounted cash flows confirm the minimum amount needed for a bid if the company was an acquisition target. Less than one means there is good upside potential.		1.04 (10% DR) 0.86 (8% DR)
EBITDA (Millions). Annual taxable income. After taxation used to provide a dividend stream and can be used for share buyback. Essentially returning cash to shareholders rather than investing in new projects.	\$3,400	
EV/EBITDA. A ratio of 10 means that undiscounted earnings would generate an income approaching the market capitalisation. A higher value could be indicative of a long life quality project. The range for the mining industry normally lies between a ratio of 6 to 8 so for this case study the project is correctly valued.		6.41

The significant change in P/NAV and EV/NPV from >1.0 to <1.0 reflecting increase in NPV for the same model depending on the choice of DR (10% compared to 8%) demonstrates the utility of the ratios. They provide a useful indicator of how the intrinsic value of a mining asset is very sensitive to the impact of future cash flows. This feels intuitively correct, but it does highlight the importance of designing a realistic model for the base case JV Operation. It also assumes this is representative of the other operations.

Strategically speaking the key challenge for copper mining project financing is to match their long-life mines with the life of loans; Project financing allows them to extend the amortization period (Cunningham, 2025).

Case Studies - Valuation of a Multiple Operation Polymetallic (Ni-Cu-Precious Metal and Zn) Mining Company (Senior)

Introduction

A smelting operation may be a separate business unit and analogous to the down-stream processing of petroleum products in the oil industry. It is only after smelting and refining that metals such as zinc and lead are produced in their pure elemental state so that revenue can be directly linked to market spot prices. Metals businesses that specialise in mining, smelting, and other operations (including trading) have a business strategy based on producing concentrate from their own mining operations being sent either to their own metals processing facility or sold on directly into the market. Such companies can source concentrate for metals processing from third party mines which permits flexibility.

Smelters enter into two main types of agreements with suppliers of concentrate:

- Off-take Agreements — the supplier sells the concentrate to the smelter.
- Toll Smelting — the smelter processes the concentrate on behalf of the supplier.

For toll smelting, there is a treatment charge, refinery charge (TC/RC) and price participation (PP). The implementation of PP allows the smelter to adjust the RC depending on changes in the spot price of the metal.

There is a narrative around the difference between toll smelting and net smelter return (NSR) and this is based on off-take agreements. A base metal mine would not expect to receive much more than 60% of spot price for the metals contained in the concentrate. There would also be penalties for impurities and moisture.

Both off-take and toll smelting agreements result from negotiation between the mine producing concentrate and the smelter and can be quite complex; parties would normally be reluctant to disclose details. This is understandable as the agreements are normally confidential documents.

Case Study

In this case study the Fennoscandian-based company has complete ownership, and the business model is based on managing an integrate up-stream mining and mineral processing operations that provides concentrate to their downstream smelting and refining facilities. The company mines a range of wholly owned mines extracting ore from different mineral deposit types. These operations are as follows:

A - Porphyry Magmatic Hydrothermal deposit. Open Pit. SR 1:1. Sustaining capital of \$200M assumed. Corporate tax rate for mines in Sweden is 22%, 30% used in DCF model.

B - Volcanogenic massive sulphide (VMS) deposit. Underground mining method, cut-and-fill and undercut-and-fill. Assume \$25/tonne. Tax rate of 22% used.

C - Magmatic Mafic Sulphide. Open pit. SR 1:3. Capex of \$484M assumed. Corporate tax rate in Finland is 20%, 30% used in initial DCF model.

D, 1 & 2 – VMS deposit, UG Cut-and Fill.

D, 3 - Mineralisation associated with an alteration zone in a suite of felsic volcanic and volcanoclastic rocks.

E - carbonate-hosted lead-zinc ore deposit. Underground long-hole open stoping mining method. Under care-and-maintenance.

The assumptions used in the case study are given in Table 8.

Wholly Owned Mines. Resource Base – Table 8.

Opertn	Resv Mt	Prodn Mtpa	Mine Life years	Zn %	Pb %	Cu %	Ni %	Au g/tonne	Ag g/tonne	Pt g/tonne	Pd g/tonne
Metal Price				\$2,750/ tonne	\$2,000/ tonne	\$9,500/ tonne	\$16,300/ tonne	\$3,300/ ounce	\$36/ ounce	\$1,200/ ounce	\$1,100/ ounce
A	905	45	20			0.23		0.12			
B	124	3.45	36	2.80	1.30	0.05		0.35	70		
C	182	9.45	19			0.33	0.24	0.70		0.20	0.14
D, 1	12.74	0.75	18	6.00		0.40					
D, 2	2.06			6.20	1.20	0.40		2.4	133		
D, 3	1.52	0.45						3.41	9.9		
E	40	2.60	15	5.50							

Discounted cash flow models were generated for operations A, B and C using a discount rate of 10% and a tax rate of 22%. Metal price assumptions were given in the Table above.

A mine and plant expenditure of \$484 million was assumed for operation C. Sustaining capital of \$200 million over the first five years was assumed for Operations A and B. The after tax NPVs for operations A, B and C are \$1,466 million. \$2,772 million and

\$2,955 million respectively.

For operation C revenue for Cu + Ni is 72% of total revenue of \$833 million in the first year of full production. Au is 18% with the platinum group elements contributing 10% demonstrating the importance precious metals have in generating revenue and supporting the commercial viability of the operation.

The accounts consolidate both upstream and downstream activities. The company's facilities provides about 30% excess smelting capacity over a range of metals so they have entered off-take agreements with other companies. Historically while revenue from the downstream activity was 3x that of the upstream, the profits from upstream activities were double that from downstream. Trading comparables for the case study are given in Table 9.

Share Performance Metrics of a Multiple Operation Polymetallic Mining Company - Trading Comparables – Table 9.

Description	Variable	USD	Indicator
Share Price		\$30.28	
Earnings/share		\$2.77	
Market Capitalization (Millions)		\$8,313	
Fully Diluted Shares Outstanding (Millions)	273.51		
Price/Earnings. 20-25 is good, the lower the better. A low price compared to earnings suggests doubt about viability			10.93
Dividend		\$0.77	

For this case study scenario operating profits for the mining operations are given in Table 10. NPV assumes 100% holding. Smelters -70% of concentrate sourced externally.

Profile of Wholly Owned Mines – Table 10.

Operation	Revenue M\$ pa	NPV \$M @ DR 10%	Profit or Loss \$M pa
Mine A	1,183	1,466	74
Mine B	579	2,772	365
Mine C	833	2,955	74
Mines D1, 2 & 3		0.105	232
Mine E	0		-95
Exploration			-138
Total Mines (42%)			512
Smelters (48%)			698
Total	3,089	6,948	1,210
Total (Scaled from Mines)		16,425	

For Operation A which is essentially a copper project, of the total annual revenue of \$1,183 million, gold contributes \$378 million (32% of the total) albeit present in low grades. This may impact on plant recovery reducing the actual benefit but again it does demonstrate the importance of precious metal credits to projects exploiting polymetallic deposits.

The relatively limited reserves associated with operations D meant that there was only a modest NPV of \$105 million but given that the mines are associated with a major metallogenic province and the focus of active exploration this remain and important, albeit intangible asset.

Operation E is on care-and-maintenance which could be brought back into production if there is a significant increase in zinc price. Share performance metrics are given in Table 11.

Share Performance Metrics of a Multiple Operation Polymetallic Mining Company - Capitalisation – Table 11

Description	USD	Indicator
Market Capitalisation Millions)	\$8,313	
Debt (Loans) (millions)	\$1,048	
Enterprise Value (Millions). Market Capitalisation + Debt - Cash - Investments. The minimum amount needed if the company was an acquisition target.		\$9,360
NPV (DR 10%) Millions. NPV for operations A, B, C & D assuming the mining operations represents 42% of the value of the company with the balance derived from smelting and refining business.	\$17,004	
Net Asset Value (NAV) Millions. NPV - Debt + Cash + Investments. Intrinsic worth of the company. A bench mark if the company was an acquisition target.	\$15,956	
NAV/Share (\$/share)		\$58.34

The analysis of the primary share and DCF models is given in Table 10 from which insights into the valuation of the company are obtained and these are given in Tables 11 and 12.

Share Performance Metrics of a Multiple Operation Polymetallic Mining Company - Valuation – Table 12.

Description	USD	Indicator
P/NAV (Share Price/NAV). Share Price/Net Asset Value. A ratio below 1 is a good multiple since it suggests that that the shares are undervalued.		0.52
EV/NPV. A ratio of one means that the discounted cash flows confirm the minimum amount needed for a bid if the company was an acquisition target. Less than one means there is good upside potential.		0.59
EBITDA (Millions). Annual taxable income. After taxation used to provide a dividend stream and can be used for share buyback. Essentially returning cash to shareholders rather than investing in new projects.	\$2,000	
EV/EBITDA. A ratio of 10 means that undiscounted earnings would generate an income approaching the market capitalisation. A higher value could be indicative of a long life quality project. The range for the mining industry normally lies between a ratio of 6 to 8 so for this case study the project is correctly valued.		4.68

This case study assumes complete ownership of all the operations. There would be an additional level of complexity if the controlling company of the polymetallic deposits held only partial ownership. NPV may well have to be determined based on the Free Cash Flow Forecast (FCFF).

Given the sound financial framework for the company, they could in addition to undertaking exploration to locate extensions to exiting mineral deposits or satellite deposits that could sustain feed to existing mineral processing facilities, the business strategy could include acquisition of existing mines operated by separate companies. Funding could be through a combination of debt and equity.

Case Studies - Valuation of a Single Operation Gold Mining Company (Production Junior)

Introduction

While gold deposits seem to be ubiquitous within the geological record with thousands of gold occurrences described in the scientific literature and the extractive metallurgy for non-refractory ores being relatively straight forward, many deposits are small and structurally complex. For the gold mining companies with multiple operations an efficient way of expanding their reserves would be through the acquisition of an existing single operation gold mining company. Closure of the transaction will of course be dependent on both parties agreeing on the intrinsic value of the operation and then negotiating a price that offers a premium on the existing share price. The case study addresses this scenario.

Case Study

In this case study the company based in North Africa mines 12.4 million tonnes of ore from a single open pit with a grade of 1.0 g/tonne and has started underground mining with a target production of 1.5 million tonnes per annum at a grade of 2.0 g/tonne. It used its free cash flow to develop the underground mine. A programme of exploration has resulted in a deposit that evaluation drilling has demonstrated the presence of a near surface resource of 143 million tonne with a grade of 1.25 g/tonne. The combined NPV of these assets in \$1,000 million shared equally between the existing mine and the undeveloped project. Share performance metrics are given in Tables, 13, 14 and 15.

Share Performance Metrics of a Single Operation Gold Mining Company - Trading Comparables – Table 13.

Description	Variable	USD	Indicator
Share Price		\$1.68	
Earnings/share		\$0.41	
Market Capitalization (Millions)		\$1,954	
Fully Diluted Shares Outstanding (Millions)	1,165.35		
Price/Earnings. 20-25 is good, the lower the better. A low price compared to earnings suggests doubt about viability			40.98
Dividend		\$0.04	

Share Performance Metrics of a Single Operation Gold Mining Company - Capitalisation – Table 14.

Description	USD	Indicator
Market Capitalisation Millions)	\$1,954	
Debt (Loans)	\$0	
Enterprise Value (Millions). Market Capitalisation + Debt - Cash - Investments. The minimum amount needed if the company was an acquisition target.		\$91,954
NPV (DR 10%) Millions. NPV for operations A - D assuming the mining operations represents 42% of the value of the company with the balance derived from smelting and refining business.	\$1,000	
Net Asset Value (NAV) Millions. NPV - Debt + Cash + Investments. Intrinsic worth of the company. A bench mark if the company was an acquisition target.	\$1,000	
NAV/Share (\$/share)		\$0.86

Share Performance Metrics of a Single Operation Gold Mining Company - Valuation – Table 15.

Description	USD	Indicator
P/NAV (Share Price/NAV). Share Price/Net Asset Value. A ratio below 1 is a good multiple since it suggests that that the shares are undervalued.		1.95
EV/NPV. A ratio of one means that the discounted cash flows confirm the minimum amount needed for a bid if the company was an acquisition target. Less than one means there is good upside potential.		1.95
EBITDA (Millions). Annual taxable income. After taxation used to provide a dividend stream and can be used for share buyback. Essentially returning cash to shareholders rather than investing in new projects.	\$398	
EV/EBITDA. A ratio of 10 means that undiscounted earnings would generate an income approaching the market capitalisation. A higher value could be indicative of a long life quality project. The range for the mining industry normally lies between a ratio of 6 to 8 so for this case study the project is correctly valued assuming that the share price is responding to an announcement that the company is an acquisition target.		4.91

Instead of using free cash to develop the underground mine as was the strategy, an alternative funding strategy could have been the use of debt in combination with a stronger dividend stream. This might have enhanced share performance metrics and been a better option for the shareholders. As the matters stand with zero debt, the company would be an obvious takeover target. This is the scenario outlined in the section dealing with dilution and accretion. By pricing shares at a 20% premium a board would probably need to recommend that such an offer be accepted. In the scenario outlined in the next case study a Major International Mining (MIM) gold company takes over a junior gold company the 25% accretion in the value of the shareholding would be the driver. While dilutive with respect to the original shareholding, was accretive with respect to the value of the holding.

Case Studies - Valuation of a Multiple Operation Gold Mining Company (Global Giant)

Introduction

Producers are always chasing new reserves to replace ore extracted because that is traditionally how share price was enhanced. "Ounces in the ground" was the mantra. A single operation gold mining company of the type considered above, given that its long-term viability is dependent on replacing a wasting resource as extraction is undertaken, doing nothing is not an option. A viable future can only be achieved through exploration and locating extensions of the mineralisation in the existing operation or acquisition of other mines. The probability is that a single operation company as outlined above will itself be an acquisition target by an existing multiple operation gold mining company as considered in this case study.

While there is a direct correlation between gold price and the share performance of gold mining companies, not many can outperform this simple relationship. A likely explanation for the failure to benefit from the correlation is that the easiest way to report enhanced probable reserves is to convert indicated resources into reserves by reducing the cut-off. If costs are already well controlled, then any increase in the gold price allows gold at a lower grade to be extracted. The volume of rock to be processed remains the same so little benefit is accrued to the operation or the shareholders in the holding company as less gold is produced. There is a separate narrative which is that miners pay more than the intrinsic value of project as part of an acquisition strategy. This results in capital destruction.

In this case study the company has multiple operations and a wide geographical spread. In addition, it has been very successful in replacing resources through exploration, not by simply lowering cut-off grade on existing operations. Assessment of exploration potential of target projects should include the application of the Black Scholes option pricing model and the techniques of Real Option Valuation based on deferring the development of a resource in the expectation of more favourable metal prices as shown case study 1, Buchanan 2025a.

Case Study

This case study considers the situation where a Global Giant as defined in this paper but also classified as a Major International Mining (MIM) gold company takes over a junior gold company. The former has multiple operations while the latter has a single operation with a promising undeveloped project at the evaluation and prefeasibility stage. Consider the following scenario:

Prior to the takeover bid the Junior's shares are priced at \$2.04/share with 1,167 million fully diluted shares outstanding giving a market capitalisation of \$2,390 million. The share price of the MIM was 28.40/share with 420 million fully diluted shares outstanding giving a market capitalisation of \$11,930 million. The deal involves an exchange of each share in the Junior being exchanged for 0.07 new MIM shares. Shareholding for the Junior would change from 1,167 million to 81.7 million. NewCo would then have a 501.4 million shares outstanding with the original shareholders of the Junior holding 16.3% of the NewCo. After closure the new shares traded at \$36.96/share giving a market capitalisation of \$18,531 million because of the perceived synergies and enhanced valuation flowing from the transaction.

An investor holding 100 shares in the junior originally worth \$204, after the transaction would own 7 shares worth \$258.72. While dilutive with respect to the original shareholding, was accretive with respect to the value of the holding. Of course, to achieve this level of uplift, prior to the acquisition a careful analysis of the technical characteristics of the asset being evaluated would be required

The second case study considers a company that has seven operating gold mines in Canada and separate mines in Finland, Mexico and Australia and Fennoscandia comprising both open pit and underground operations. Extractive metallurgy includes hydrometallurgical processing of non-refractory ore as well as processing of refractory ore. For the later this involves a precursor pressure oxidation stage prior to conventional CIL extraction of the gold. The company has made investments in a number of junior companies with advanced gold evaluation programmes

It would clearly be a formidable and time-consuming task to generate DCF models for each mine as well as for the advanced evaluation projects. In these circumstances the Free Cash Flow Forecast (FCFF) method has been used. The 2024 net income was given as \$1,900 million and this was escalated by 15% for the next ten years. These values were then discounted by 4% to generate a NPV of \$35,000 million for the assets. Share performance metrics are given in Tables 16, 17 and 18.

Share Performance Metrics of a Multiple Operation Gold Mining Company - Trading Comparables – Table 16.

Description	Variable	USD	Indicator
Share Price		\$116.19	
Earnings/share		\$4.60	
Market Capitalization (Millions)		\$58,406	
Fully Diluted Shares Outstanding (Millions)	503		
Price/Earnings. 20-25 is good, the lower the better. A low price compared to earnings suggests doubt about viability			25.25
Dividend		\$1.56	

Share Performance Metrics of a Multiple Operation Gold Mining Company - Capitalisation – Table 17.

Description	USD	Indicator
Market Capitalisation Millions)	\$58,406	
Debt (Loans) (Millions)	\$1,140	
Enterprise Value (Millions). Market Capitalisation + Debt - Cash - Investments. The minimum amount needed if the company was an acquisition target.		\$59,546
NPV (DR 10%) Millions. NPV for operations A - D assuming the mining operations represents 42% of the value of the company with the balance derived from smelting and refining business.	\$25,180	
Net Asset Value (NAV) Millions. NPV - Debt + Cash + Investments. Intrinsic worth of the company. A bench mark if the company was an acquisition target.	\$24,040	
NAV/Share (\$/share)		\$47.82

Share Performance Metrics of a Multiple Operation Gold Mining Company - Valuation – Table 18.

Description	USD	Indicator
P/NAV (Share Price/NAV). Share Price/Net Asset Value. A ratio below 1 is a good multiple since it suggests that the shares are undervalued.		2.43
EV/NPV. A ratio of one means that the discounted cash flows confirm the minimum amount needed for a bid if the company was an acquisition target. Less than one means there is good upside potential.		1.70
EBITDA (Millions). Annual taxable income. After taxation used to provide a dividend stream and can be used for share buyback. Essentially returning cash to shareholders rather than investing in new projects.	\$4,204	
EV/EBITDA. A ratio of 10 means that undiscounted earnings would generate an income approaching the market capitalisation. A higher value could be indicative of a long life quality project. The range for the mining industry normally lies between a ratio of 6 to 8 so for this case study the project is correctly valued.		14.16

The performance metrics are indicative of a high-quality company with potential for growth. An investor can expect a strong dividend yield and respectable capital appreciation with any increase in the gold price.

Analysis of Results

As can be seen in Table 19, based on share performance metrics, the cases studies in this paper cover the full spectrum of possible Trading Comparables and Valuation indicators which is indicative of a diversified mining share portfolio. This is the best quantitative way of reducing risk while having a position from which to benefit from factors likely to enhance value.

Valuation of Mineral Projects Modelled in the Case Studies Based on Share Performance Metrics – Table 19.

Case Study	Single Operation Cu	Multiple Operation Cu	Multiple Operation Poly-metallic (Ni-Cu-PGM & Zn)	Single Operation Gold	Multiple Operation Gold	Metric and Range	Interpretation and Implication
Market Cap (Millions) Trading Comparable	\$595	\$20,154	\$8,313	\$1,954	\$58,406	The Major International Mining Companies have a minimum of \$100 million Market Capitalisation.	Investors assign a risk discount to single-asset miners and a diversification premium to multi-asset producers.
Price/ Earnings Trading Comparable	17.61	21.32	10.93	40.98	25.25	20 - 25 is good, the lower the better	A low share price compared to earnings therefore a low ratio suggests expectation of high growth potential. Polymetallic operations trade cheaper due to complexity and variable metal prices.
Price/Net Asset Value (P/NAV) directly relates market value to the discounted cash flow generated by the underlying mineral reserves. Valuation	0.77		0.52			<1.0	Trading at a discount to NAV. Often in undervalued funds, distressed assets, or cyclical downturns. possible acquisition target.
		1.06				=1	Trading at par with NAV. Fairly valued. The company is trading near its intrinsic value
				1.95	1.72	>1.0	Trading at a premium to NAV Seen when investors expect strong growth, superior management, or hidden asset value. Gold projects receive large NAV premiums, while copper and polymetallic projects often trade at discounts.
Enterprise Value/Net Present Value (EV/NPV). Incorporates both equity and debt, offering a	0.80		0.59			<1.0	Possibly undervalued and an acquisition opportunity
		1.04				=1	Market value ≈ intrinsic value.

comprehensive representation of the company's total market value				1.95	1.70	>1.0	Fairly valued
							Possibly overvalued or having a strategic premium
Valuation							
Enterprise Value/ EBITDA	4.36	6.41	4.68	4.91	14.16	The range for the mining industry normally lies between a ratio of 6 to 8	A ratio of 10 means that undiscounted annual earnings multiplied by 10 would generate an income approaching the market capitalisation. A higher value could be indicative of a long-life quality project.
Valuation							Very high multiples can also suggest overvaluation or speculative pricing.

The valuation analysis reveals clear structural patterns in mining equity markets that can be summarised as follows:

- Multi-asset companies command valuation premiums due to diversification and stability.
- Gold producers trade at the highest valuation multiples, reflecting financial demand for gold.
- Copper and polymetallic projects frequently trade at discounts, indicating cyclical and operational risk perceptions.
- EV/NPV and P/NAV ratios highlight potential acquisition opportunities, particularly in copper and polymetallic assets.
- High EV/EBITDA multiples often reflect long-life, high-quality projects, but may also indicate speculative pricing.

Investors reward scale, diversification, and gold exposure, while single-asset and polymetallic miners tend to trade at valuation discounts that can create strategic acquisition opportunities.

Using Enterprise Value/EBITDA goes some way to resolving variations in capital structure for international mining companies by removing the distorting effects of debt financing by measuring the value of the entire business enterprise rather than just its equity (Kirk, 2025)..

While geographical spread and qualitative factors, notably Environmental, Social, and Governance (ESG) considerations are obviously also important in compiling a mining share portfolio these are difficult to quantitatively model other than through consideration of items such as the cost of political risk insurance. There is also commodity diversification within the portfolio that offers a major advantage over the rival natural resource business represented by oil and gas with its restriction to hydrocarbons. The minerals industry is based on the extraction of elements that represent a large proportion of the periodic table.

The modelling approach used in this paper is essentially deterministic with no stochastic treatment based on techniques such as Monte Carlo simulation that presents NPV as a range of outcomes. In their paper Caceres and Emery (2026) it is recognised that the stochastic approach used in the field of quantitative finance applies many of the same concepts used in the field of geostatistics. They demonstrate that with increased expenditure on sampling at the prefeasibility stage of value creation in mineral projects there might be a corresponding reduction in the uncertainty of the estimate of NPV. Financial modelling at the full technical feasibility study stage, however, is aimed at optimisation of NPV based on the ratio of debt and equity.

Once a project is in production and part of the assets of a listed company, as outlined in this paper, then financial reporting is constrained by actual performance. A share investment decision is then based on simple options - to buy, sell or hold. Provide the

investor has confidence in the model then it should provide the basis for a rational decision[1]. The classic financial risk management advice is “build in what you believe to be a maximum downside and trust your models”.

The market capitalization is probably the key valuation indicator. With an \$8.3 billion market capitalisation with a Price/Earnings ratio of 11, the multiple operation exploiting polymetallic deposits (MOEPD) and having an integrated smelting and refining capability is perhaps associated with the lowest risk as it is itself diversified within the diversified portfolio described in this paper. This could theoretically be applied to some of the major international mining companies (IMC) classified as Global giants (USD above 12 billion) in this paper (Hodge, et al, 2022). These have the same technical features as the MOEPD case study but are associated with a minimum of \$100 billion market capitalisation. Price/Earnings ratio typically lie in the range 7 to 11 and are not therefore that different from the MOEPD case study. A balanced portfolio may well include shares in IMCs, but the level of complexity needed to generate the performance metrics as outlined in this paper does require the resources of a corporate finance department.

[1] The models used in this paper are analogues of actual companies. Between July and September 2024, based on the performance metrics generated in this paper, the author bought shares in three of the mining companies. These were the Multiple Operation Copper, Multiple Operation Polymetallic and the Multiple Operation Gold. Market capitalisation gain for each on the date of submission of the manuscript (June 2026) was 104%, 55% and 53% respectively. In addition, healthy dividend streams were received from all three companies.

Conclusions

The comparative analysis of mining valuation metrics highlights the significant influence of operational scale, commodity type, and perceived risk on share performance. Multiple-operation companies consistently achieve higher valuations due to diversification benefits, while single-asset producers often trade at discounts reflecting greater operational vulnerability. Gold producers command the highest valuation multiples because of strong investor demand and the strategic role of gold as a financial asset. In contrast, copper and polymetallic producers typically trade closer to intrinsic asset value or at modest discounts due to commodity price cyclicity and operational complexity.

The deliverable in applying the concepts outlined in this paper would be templates that generate key valuation performance metrics which would include P/NAV, EV/NPV and EV/EBITDA based on operational and financial variables. This would allow projects to be ranked according to intrinsic value and thereby identifying which might be given priority in creating a mining share investment portfolio or in the new the new business development divisions of the mining companies.

The significant change in P/NAV and EV/NPV in Part 3 (Valuation of a Multiple Operation Copper Mining Company) from >1.0 to <1.0 reflecting increase in NPV for the same model depending on the choice of DR (10% compared to 8%) demonstrates the utility of the ratios. They provide a useful indicator of how the intrinsic value of a mining asset is very sensitive to the impact of future cash flows. These in turn are dependent on the technical assumptions used requiring a robust understanding of the basis for reporting the reserves, the minerals engineering aspects of the operation and the financial reporting conventions used by the company.

Any market turbulence increases the need to understand the interrelationship between technical and financial risk to recognise potential investment opportunities. The key consideration is the intrinsic value of a mineral project. Where current market conditions undervalue the true long-term worth of assets, which are then reflected in low share prices, strategic planning can identify opportunities.

The theme in the paper gives strong emphasis on the merits of the use of debt for capital raising and thereby releasing cash and permitting a stronger dividend stream. This in turn enhances share price and therefore market capitalisation and allows accretion to offset dilution in a rights issue as the equity component to a capital raising. The tradition in the international mining industry has been to use free cash to develop projects whether this is expansion of production, upgrading metallurgical facilities or to develop satellite deposits. Persuading mining industry clients of the merits of using debt for development of course provides a framework for the type of role an investment bank would be expected to play in mining finance.

Declarations

Author Contribution

Single authorship. Models used in the paper were generated by the author personally as are the applications and interpretation.

Data Availability

Excel-based financial models have been developed to determine the interrelationship between technical and financial risk in mineral projects. These integrate an understanding of geology, mining, processing and sources of capital to improve the speed at which potential projects might be assessed and financed. This includes an analysis of how chances of success could be enhanced through an improved integration of financial and technical appraisal. Models are based on case studies that include the following valuations:• Single Operation Companies• Multiple Operation Copper Mining Company• Multiple Operation Polymetallic (Ni-Cu-Precious Metal and Zn) Mining Company• Single Operation Gold Mining Company• Multiple Operation Gold Mining CompanyBased on share performance metrics, the cases studies cover the full spectrum of possible Trading Comparables and Valuation indicators which is indicative of a diversified mining share portfolio.

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