

# Discount Rate Selection

The three principal factors that have the greatest effect on the valuation of a mineral property are:

- reserves,
- metal price,
- discount rate.

Generally reserves can be defined to the point where the owner, the investor and the banks have a comfort level. Generally, metal prices are unknowable, except that they will rise and fall in an irregular cyclic pattern. Generally, discount rates are selected arbitrarily and applied in a less than studied manner. The purpose of this paper is to describe their selection and application.

## Selection

Discount rates actually fall within a narrow range of values, from 0% at the extreme low end to around 20% at the high end. Values are often chosen arbitrarily and a few percentage points here or there are casually added or removed. However, the selection of the discount rate needs considerable attention. For a 15 year project, the difference of just a single percentage point in the range of a 10% discount rate can shift the value by 5%-7%.

Discount rates are typically selected by one of several methods:

1. Corporate policy
2. Industry practice
3. Risk adjusted discount rate
4. Weighted average cost of capital (WACC)

### Corporate policy

Large corporations often have pre-determined discount rates which have been set on some basis, often the corporation's WACC.

### Industry Practice

There are general ranges of discount rates that are typically used for evaluation. Analysts tend to use discount rates in the range of 10% for base metals and from 5%-8% for gold companies. Table 1 shows the results of a survey that indicate the discount rates used for these two commodities over a range of risk levels.

Table 1- Industry Practice Survey - Discount Rates  
(Real, No Debt)

(L. D. Smith survey of analysts, consultants, and corporate personnel  
at CIM Mineral Economics Society symposia.)

Level of Knowledge	Base Metals	Gold
Order of Magnitude Estimate	17.7%	17.4%
Pre-Feasibility Study	13.3%	11.3%
Feasibility Study	11.3%	8.8%
Operating Mine	8.6%	5.3%

It is also instructive to see what analysts use for their evaluations. Some typical examples are shown in Table 2. Generally these rates apply to companies rather than projects.

Table 2- Industry Practice - Analyst Discount Rates  
(Real, No Debt, North American Companies)

Analyst or Company	Gold	PGM	Base Metals
RBC Capital Markets	5%	8% (1)	8%
Merrill Lynch	5%	5% (2)	10%
BMO Nesbitt Burns	0%	3% (3)	-
Goldman Sachs	5%	-	10%
TD Newcrest	3%	-	10%
UBS Warburg	5%	-	-

1. RBC report on Stillwater, April 19, 2002
2. Merrill Lynch includes PGM in a table of gold valuations done at 5% and does not indicate that a different rate is used for PGM
3. BMO comment on NA Palladium, November 26, 2001

### Risk Adjusted Discount Rate

A risk adjusted discount rate is one that is built up from the basics components of interest and risk. A base interest rate is determined and components are added to reflect increments of risk. Factors are added to reflect items such as the inherent risks associated with mining (reserves, geological unknowns, metal prices, recoveries, etc), risks associated with lack of information (which can be mitigated by further study), country risks, and any other project specific risks that are not addressed specifically in the capital or operating cost estimates. An example is set out in Table 3.

Table 3 - Risk Adjusted Discount Rate (Real, No Debt)

Component	USA	Peru
Risk-Free, Long-Term Interest Rate (Real)	2.5%	2.5%
Mining Project Risk	5.0%	5.0%
Risk for Level of Knowledge (say, Feasibility Study)	2.5%	2.5%
Country Risk (Assume USA=0%)	0.0%	2.0%
Project Specific Discount Rate	10.0%	12.0%

### Weighted Average Cost Of Capital (WACC)

The WACC is made up of the weighted proportions of the cost of equity, the cost of debt, and the cost of bonds, all expressed as interest rates. The values for debt and bonds are directly expressed as interest rates and are fairly straightforward. The equity portion must be calculated using the Capital Asset Pricing Model (CAPM) which employs stock market data, specifically the beta value of the corporation (a measure of the volatility of the stock relative to the market) which is multiplied by the risk premium of the market and added to the long term risk-free return (usually 3-month US government bonds). WACC develops a nominal rate that includes inflation and debt effects. CAPM develops a nominal rate that includes inflation and excludes debt effects. The cash flow and discount rate must be consistent with each other in terms of inflation (real or nominal) and debt (included or not).

The CAPM rate is a reflection of the corporate entity, not a specific project, and the rate calculated will have to be adjusted to reflect the specific project. In this way CAPM is similar to the risk adjusted method where risk factors are added to the base rate associated with the company's stock to reflect the specifics of the project, including the level of knowledge and country risk, among others. In terms of country risk, it is worth noting a personal experience with a company that was listed in South Africa. The feeling was that it should subtract (rather than add) a risk factor from its South African WACC because the project being considered was in Chile, which was perceived to be less risky than South Africa. Table 4 shows a possible

calculation for a project for two companies, one listed in South Africa and one listed in USA.

Table 4 - Risk Adjusted CAPM Discount Rate (Nominal) For a Project in Chile

Component	RSA	USA
Long-Term Risk Free Interest Rate	6.6%	6.6%
Market Premium (5.0%) times Corporate Beta (1.1)	5.5%	5.5%
CAPM Cost of Equity Capital	12.1%	12.1%
Risk for Level of Knowledge (say Feasibility Study)	2.5%	2.5%
Country Risk (Chile relative to listing country)	-1.0%	1.0%
Project Specific Discount Rate (Nominal)	13.6%	15.6%

## Application

### Inflation

When determining a discount rate it is necessary to ensure that a nominal rate (with inflation) is applied to a cash flow that is calculated in nominal dollars. If the cash flow is in real dollars, the discount rate needs to be in real terms. The relationship between these rates is given in the following equation:

$$(1+R) = (1+r)(1+i)$$

where:

R = Nominal discount rate

i = Inflation rate

$r_p$  = Real discount rate

For example, a nominal discount rate of 13.6% and an inflation rate of 3.0% would convert to a real discount rate of 10.3%. The math for this is:  $(1.136)/(1.03) = 1.103$ .

### Equity

If a cash flow is calculated on a 100% equity basis (most banks prefer to see this case), then the all equity discount rate must be used (CAPM is 100% equity rate). If the cash flow is calculated on a debt basis, the discount rate should be adjusted to reflect this (WACC includes the corporate debt profile.).

### Country Risk

There are political and economic risks associated with most countries. Since the present area of interest is the United States, this is not a significant factor. The United States is generally considered to have zero country risk. But this is based on a broad spectrum of corporate investment, and many mining companies would argue that the United States is quite an unfriendly place to be. Certainly some states are actively anti-mining (Wisconsin), while others are actively pro-mining (Nevada, Alaska). Throughout the country, there is a very real probability that project initiatives will be delayed by environmental hearings and procedures as well as protests and NGO activities. An investor may want to recognize this with costs and timing delays in the project cash flow, or alternatively, in a higher discount rate. However, much of the environmental review process is now dictated by law and the timetables are generally known. Once the permitting is accomplished, and the mine is in operation, the United States provides a stable legal and political environment in which to operate.

## Corporate versus Project

It is necessary to distinguish between a corporation and a project for several reasons:

1. Discount rate
2. Market premiums for a company
3. Market premiums based on country of listing

### Discount Rate

Market based discount rates (WACC and CAPM) are a measure of the corporation, not the project. Typically, a green-fields project will attract a higher discount rate than the corporation. For example, if a

company's assets are in operating mines, a green-field project will be more risky and should have a higher discount rate than the corporate WACC. On the other hand, if a company's assets are in development projects, and the project being evaluated is an operating mine, then the discount rate for the operating project would likely be lower than the corporate WACC.

#### Market Premiums for a Company

Having developed a logical rationale for a discount rate in the previous paragraphs, it is necessary to point out a phenomenon that seems to fly in the face of this logic. Put simply, for gold companies, the value of the company trading on the market is higher than the combined value of its individual assets (measured on a net present value basis). That is, ratio of Price to Net Asset Value (sum of NPV of all properties plus cash less debt) is higher than 1.0. The larger the company, the larger the effect. While this premium has changed over time, it has existed for at least the past decade. The market for PGM companies is small relative to the gold market, but indications are that PGM stocks may experience a similar, but reduced effect. Some typical values from recent analyst reports are shown in the Table 5. (See additional tables at the end of this report.)

Table 5 - P/NAV Premiums For Gold and Platinum Companies

Index or Company	P/E	P/CF	P/NAV @ 0%	P/NAV @ 5%
Senior Gold	33-40	10-20	~1.4	~2.1
Junior Gold	20-35	11-17	~1.4	~2.1
PGM	10-20	5-15	~.6	~1.3

The values in this table, and the very limited population that they represent, suggest that an NAV calculated at a discount rate between 0% and 5% would give an estimation of the value that a PGM property would add to a PGM company (at least as of the first quarter of 2002, bearing in mind that these ratios vary over time).

#### Market Premiums Based On Country Of Listing

There is evidence to suggest that stocks listed on North American markets have a higher share price than similar stocks on the Australian and South African stock markets. This is believed to be a function of the greater liquidity of the North American markets and, perhaps, of the stability of these markets. Nevertheless, this effect is known and is worth noting. A subsidiary of a foreign company listed, in North American to hold a North American mining operation, may add more value to the corporation than adding the operation to an existing portfolio of properties in another market.

## Weighted Average Cost of Capital - Theory

Economic and finance theory proposes the use of the corporate cost of capital as a discount rate. This value is the weighted average cost of the funds available to a company, including common stock, debt (after tax rate), and preferred shares. Referred to as the *Weighted Average Cost of Capital (WACC)*, it is expressed as an interest rate and is calculated as follows:

$$r_{WACC} = r_e p_e + r_d p_d + r_p p_p$$

where:

$r_{WACC}$  = weighted average cost of capital  
(expressed as %)

$r_{e,d,p}$  = proportional costs of equity capital, debt (after tax), and preferred stock, (all expressed as %)

$p_{e,d,p}$  = proportions of equity capital, debt (after tax), and preferred stock that make up the corporate capital ( $p_e + p_d + p_p = 1.00$ ).

For evaluations on an *all equity* basis, only the cost of equity capital needs to be considered. (The  $r_d p_d$  and  $r_p p_p$  terms drop out because  $p_d$  and  $p_p$  are zero on a all equity basis.) There are a number of methods of assessing the cost of equity capital and expressing it as an interest rate, but the *Capital Asset Pricing Model (CAPM)* is perhaps the most widely used. The basis of this method is that the return on an individual corporate stock can be related to the stock market as a whole by the relationship.

$$r_e = f + R \beta$$

where:

$r_e$  = expected return on the common stock

$f$  = risk-free return (usually based on government bond rates)

$R$  = risk premium of market returns above long term risk free rates

$\beta$  = Beta factor for the common stock. The beta factor expresses the variability of the common stock with respect to the variability of the market as a whole. By definition, the beta of the market is 1.00. Beta values are published regularly in journals such as *US Value Line Investment Survey*.

## Tables

Table 6 - Precious Metals & Minerals – Weekly Gold Monitor – April 1, 2002

Bank of Montreal – Nesbitt Burns

Index or Company	P/E 2001	P/E 2002	P/CF 2001	P/CF 2002	Premium to 0% NAV
Senior & Intermediate North America	33.2	40.7	19.2	15.1	1.44
Junior North America	20.9	29.5	13.8	11.9	1.46
NA Palladium	31.0	9.4	14.1	4.9	.58
Stillwater	10.1	16.8	6.0	8.5	.76

Table 7 - Precious Metals & Minerals – Weekly Gold Monitor – April 8, 2002

Bank of Montreal – Nesbitt Burns

Index or Company	P/E 2001	P/E 2002	P/CF 2001	P/CF 2002	Premium to 0% NAV
Senior & Intermediate North America	33.1	42.2	18.9	14.7	1.42
Junior North America	20.4	28.4	13.2	11.3	1.38
NA Palladium	29.9	9.0	13.6	4.7	.56
Stillwater	8.5	14.1	5.0	7.1	.65

Table 8 - North American Precious Metal Producers – April 9, 2002

Merrill Lynch

Index or Company	P/E 2002	P/E 2003	P/CF 2002	P/CF 2003	Premium to 5% NAV
Senior Gold North America	32.2	34.1	12.3	11.7	2.22
Mid Size Gold North America	28.5	24.3	11.4	10.8	2.13
Small Gold North America	-	-	9.1	8.3	.90
PGM North America *	16.9	14.3	7.9	7.3	1.35
Australian Gold	24.1	21.1	8.2	9.3	-
South Africa Gold	28.8	19.2	17.0	12.6	-
South Africa PGM	12.6	10.9	11.6	8.9	-

\*PGM North America = Stillwater + Southern Era + NA Palladium

Table 9 - RBC (Royal Bank of Canada) Capital Markets – April 2, 2002

Index or Company	P/E 2002	P/E 2003	P/CF 2002	P/CF 2003	Premium to 5% NAV
Tier I Gold (NA Senior)	38.9	40.6	11.6	11.1	2.07
Tier II Gold (NA Mid & Junior)	34.7	35.8	17.0	14.3	2.11
Average	36.8	38.2	14.3	12.7	2.09

Table 10 - Analyst Metal Price Forecasts

Source	2002	2003	Long Term
Au	BMO Nesbitt Burns	295	300
	Merrill Lynch	293	305
	USB Warburg	296	302
	RBC Capital Markets	280	300
Pd	BMO Nesbitt Burns	391	400
	Merrill Lynch	380	-
	USB Warburg	361	284
	RBC Capital Markets	510	431
Pt	BMO Nesbitt Burns	469	450
	Merrill Lynch	496	-
	USB Warburg	478	527
	RBC Capital Markets	473	449

Table 11 - History of Price/NAV (RBC Capital Markets) from 1995 to 2002

Index	Range 1995-2002	Low	Trend
Tier I (Seniors)	1.25 - 1.75	~1.00 in 1998	Rising through 2.00 in 2002
Tier II (Mid & Jr)	.75 - 1.50	~.75 1999-2000	Rising through 2.00 in 2002