Pretium Resources Inc.

Real Options & Capital Structure Analysis

By: ***Hani Sbaiti***

11/8/2014

by Hani Sbaiti

Table of Contents

by Hali Sbaiti

1.0 Executive Summary

On October 29, 2010 Silver Standard Resources Inc. a Vancouver-based mining company with assets throughout the Americas and listed on both the Toronto Stock Exchange and on the NASDAQ Global Market announced the sale of Snowfield and Brucejack (the Projects), two mineral deposits in Northern British Columbia, to the newly incorporated Pretium Resource Inc. In exchange for the projects and the underlying mineral deposits, Pretium agreed to pay Silver Standard CAD $450 million: minimum CAD $215 million in cash and the balance in stock, the required capital would be raised through an IPO process. After the completion of the transaction, Silver Standard retained a significant but less than 50% ownership in Pretium.

However, the main purpose of this report is to examine certain financial aspects of this project. My analysis addresses valuation of the Projects based on the traditional discounted cash flow (DCF) method and real options valuation based on both the Black-Scholes and binomial pricing models.

There are a number of key conceptual differences between DCF and real options methods of valuation that would render the latter more appropriate. Real options analysis is more appropriate due to its ability to model more accurately decision flexibility that managers often possess in light of varying conditions that would impact projects economically. This added flexibility and the impact that managers' decisions have on future cash flows will result in a higher valuation under real options analysis compared to a DCF analysis.
Graph 1 below shows a summary of the estimated valuation of Snowfield and Brucejack when considered as a single project.

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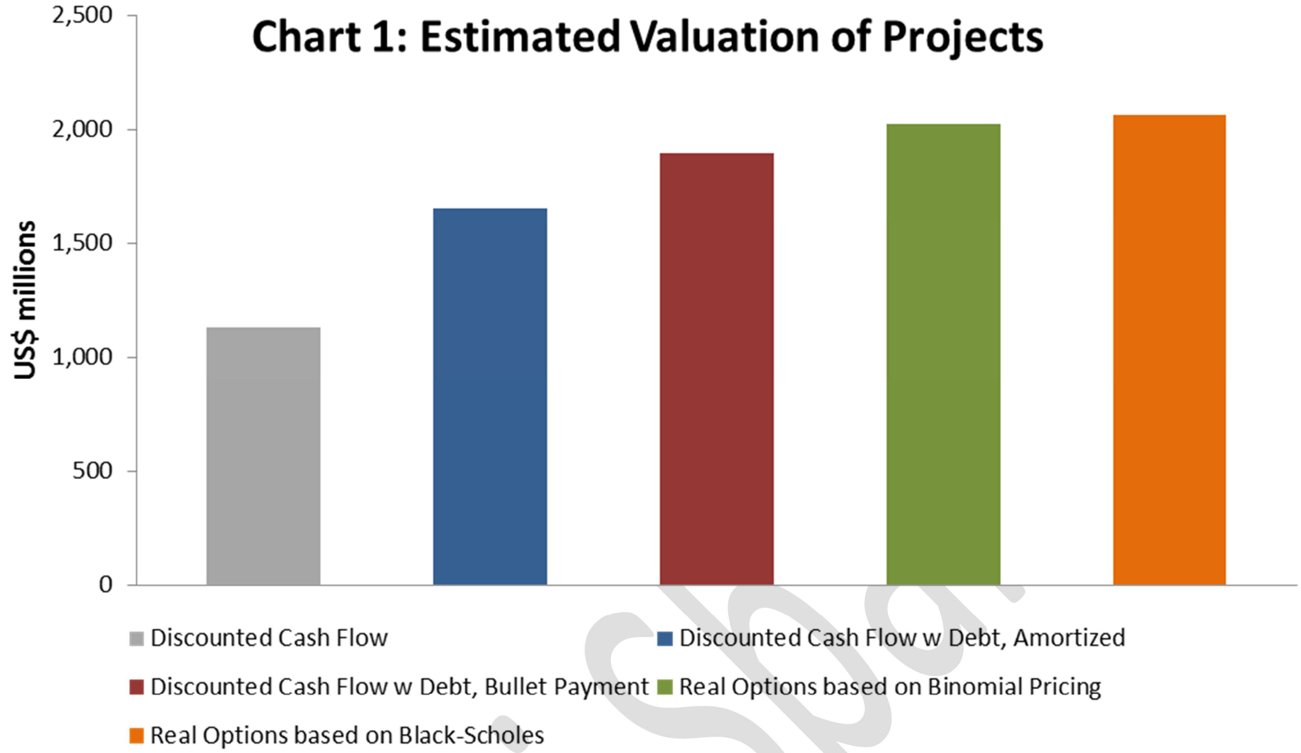

Although these estimates seem significantly higher than the actual acquisition price paid for the Projects by Pretium my report shows that they are highly sensitive to price of minerals, cost of capital and in general on subjective expectations.

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2.0 Brief Overview

Snowfield and Brucejack are two mineral deposits located in Northern British Columbia consisting of a single mineral claim with two overlapping placer claims and 6 mineral claims respectively. Previous drill programs have shown that Snowfield contains significant deposits of gold, silver, copper, molybdenum and rhenium with Brucejack containing significant deposits of gold and silver.

3.0. Preliminary Analysis

A. Statistical Analysis of Mineral Price Returns

Estimating future mineral prices is a highly subjective and is often an inaccurate process. In my analysis I used historical time series of mineral prices to estimate price variations. Historical analysis provides a better estimation of future price movements than it does of expected prices. I will then use this estimated price variation when I construct a mineral portfolio to value the Projects using real options (detailed at later parts of the report).

I have analyzed the price time series of the major minerals (gold – “Au”, Silver – “Ag”, Copper – “Cu”, Molybdenum – “Mo” and Rhenium – “Re”) constituting the economic deposits of the Projects. Table 1 shows the sources used to obtain the price time series:

Table 1: Price Sources

Mineral	Symbol	Unit	Source
Gold	Au	US $/oz	Bloomberg: Gold Spot Prices
Silver	Ag	US $/oz	Bloomberg: Silver Spot Prices
Copper	Cu	US $/tonne	Bloomberg: London Metal Exchange Daily
Molybdenum	Mo	US $/tonne	US Geological Survey
Rhenium	Re	US $/lb	Bloomberg: Engelhard Rhenium Spot Price

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Analysis of the time series of price returns, returns' covariance and correlation among the different minerals is based on the natural log of price returns. Log returns of time series offer better approximation of normal distribution characteristics than otherwise simple price returns thus reducing the estimation/expectation errors. However, when the mineral deposits are looked at as a portfolio of assets (which I will explain the rationale behind such a consideration at later segment of this report), simple return methods were used. The below formulas were used to link between Log returns and simple returns:

rt ~ N (μ, σ)

$E[R_t] = e^{(\mu + \sigma^2/2)}$

$Var[R_t] = e^{(2\mu + \sigma^2)} \times (e^{\sigma^2} - 1)$, where

- log returns of a time series "r_t" are assumed to approximate the characteristics of a normal distribution density function with a mean "μ" and standard deviation " σ "
- $E[R_t]$ is the expected value of the gross returns and
- $Var[R_t]$ is the expected variation of the gross returns

Table 2 shows the summary of the analysis done on the price time series, while Tables 3 & 4 summarizes the covariance and correlation between the log returns. The data points of the time series were limited to the shortest available time series, that of Rhenium which starts end of 2001 and ends end of 2010.

Table 2: Statistical Analysis of Mineral Prices Returns

Mineral	CAGR	Average LN Return	LN Return SD	Expected Gross Return	Annual Data Points	End 2010 Prices	Units
Au	1.05	0.05	0.16	1.06	91	1,421.40	US$/Oz
Ag	1.06	0.06	0.32	1.12	60	30.91	US$/Oz
Cu	1.14	0.13	0.41	1.24	14	9,739.25	US$/tonne
Mo	1.11	0.10	0.48	1.24	14	34,900.00	US$/tonne
Re	1.17	0.15	0.47	1.30	10	3,000.00	US$/lb

CAGR: Compounded annual growth rate

LN: Natural logarithm

SD: Standard deviation

time series ending 2010

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Table 3: Covariance between Log Return

Covariance	Au	Ag	Cu	Mo	Re
Au	0.0055	0.0106	0.0145	-0.0143	-0.0061
Ag	0.0106	0.0538	0.0807	-0.0229	-0.0184
Cu	0.0145	0.0807	0.2064	-0.0457	-0.1028
Mo	-0.0143	-0.0229	-0.0457	0.2935	-0.0302
Re	-0.0061	-0.0184	-0.1028	-0.0302	0.2202

Table 4: Correlation between Log Return

Correlation	Au	Ag	Cu	Mo	Re
Au	1.0000	0.6172	0.4295	-0.3543	-0.1754
Ag	0.6172	1.0000	0.7656	-0.1825	-0.1688
Cu	0.4295	0.7656	1.0000	-0.1856	-0.4822
Mo	-0.3543	-0.1825	-0.1856	1.0000	-0.1190
Re	-0.1754	-0.1688	-0.4822	-0.1190	1.0000

B. Modeling the Mineral Deposits as a Portfolio of Assets

The Projects could, for simplicity, be modeled as a portfolio made up of the 5 economically significant deposits. A portfolio approach would reflect (as will be discussed later) technical / processing / design limitations wherein the mine operator is not able to separate the mine into its mineral constituents. That is the operator cannot selectively process one mineral type while leaving the others unprocessed in ore or concentrate form.

The portfolio is characterized by:

- $W_i = X_i/X$; where X_i is the value of the component and $X = \sum X_i$ is the value of the portfolio
- $E[R_P] = \sum W_i E[R_i]$; where $E[R_P]$ and $E[R_i]$ are the expected return on the portfolio and components respectively
- $Var(R_P) = \sum w^2_i Var(R_i) + 2\sum w_i w_j Cov(R_i, R_j)$; where $Var(R_P)$ is the expected variance of portfolio returns and $Cov(R_i, R_j)$ is the covariance between the Log returns

Tables 5 & 6 below summarize the portfolio characteristics based on the above equations, the estimated recoverable mineral deposits of Table 16.32 (Projected Metal Production - Snowfield and Brucejack) on page 16-47 of the “Technical Report and Preliminary Assessment of the Snowfield-Brucejack Project” by WARDROP with effective date of October 28, 2010 and document no. 1053750400-REP-R0001-04 (28Oct2010 Tech Report) and mineral prices at end of 2010:

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Table 5: Mineral Portfolio Characteristics

Mineral	Unit	Snowfield	Brucejack	Total	2010 Price	Unit	Value (US$ m)	Weights
Au	oz (000)	13,918	4,995	18,913	1,421.40	US$/Oz	26,883	69.20%
Ag	oz (000)	33,548	78,800	112,348	30.91	US$/Oz	3,472	8.94%
Cu	lb (000)	1,203,750		1,203,750	9,739.25	US$/tonne	5,318	13.69%
Mo	tonne	44,920		44,920	34,900.00	US$/tonne	1,568	4.04%
Re	kg	243,320		243,320	3,000.00	US$/lb	1,609	4.14%
						Total	**38,850**	**100%**

as an approximation, minerals were valued at the commodity prices and not at the Net Smelter Return values.

Table 6: Portfolio Expected SD and Gross Return

Portfolio Expected Variance	0.0215
Portfolio Expected SD	0.1467
Expected Portfolio Gross Return	1.11

C. Estimating Asset Risk, Cost of Equity & Debt and Cost of Capital

Since Pretium Resources Inc. is a newly incorporated company with no historical financial data from which to estimate the company's risk profile (assets, equity and debt) the alternative would be to use comparable companies as a bench mark for these estimates. One could use the industry average as a benchmark, however, in my view this could be misleading. Pretium Resources Inc. has a number of traits that makes it inherently different than most other listed resource companies; namely, it's a one project company (due to proximity and planned shared operations and infrastructure Snowfield and Brucejack practically constitute a single mine), gold focused and still in the exploration phase. Thus finding companies that cover some or all of these traits would provide a better estimate and benchmark. A couple of companies that fit the bill are Torex Gold Resources and Detour Gold Corporation.

Torex Gold Resources, a debt free Toronto based resource corporation listed on the TSX (ticker: TXG) that 100% owns two gold mineral deposits in Mexico. Construction works on the first deposit is expected to be completed by end 2015. While Detour Gold Corporation is a single asset corporation that is also Toronto based and listed on its stock exchange (ticker: DGC). It owns 100% of the operational Detour Lake gold mine located in northeastern Ontario.

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For simplicity I will be only using these two comparable companies, although more can offer a better estimate of Pretium's risk profile. To make up for this shortfall, I will run sensitivity analysis on the estimates.

Table 7 below shows the data sourced on the comparable companies and the estimated value of Pretium's cost of unlevered equity. The risk adjusted model used in my analysis pertains to the Capital Asset Pricing Model (CAPM).

Table 7: Estimate of Pretium Risk Profile
Bloomberg data for Torex were based on the US market and in US$, while that for Detour was based on the Canadian market and in C$

Company	MVE	Debt	R_E	R_D
Torex Gold Resources	473	0	9.12%	0.00%
Detour Gold	2,449	481	13.46%	3.94%

Company	β	R_F	$E[R_M]$	WACC
Torex Gold Resources	0.54	2.81%	9.12%	11.90%
Detour Gold	0.80	3.12%	15.98%	11.30%

estimated effective tax	35%

Company	Estimated R_U
Torex Gold Resources	9.12%
Detour Gold Corporation	12.38%
Pretium Resource Inc.	10.75%

Source: Bloomberg Terminal, Analysis Year: 2010
MVE: Market Value of Equity
R_F risk free rate, $E[R_M]$ expected market return
R_E cost of equity, RD cost of debt, β CAPM sensitivity
WACC: static weighted average cost of capital

The estimation of R_U was based on the below capital structure formula:

$R_E = R_U + (D/MVE)*(R_U-R_D)*(1-t)$; where t is the effective corporate tax rate.

And since Pretium carries no debt currently, R_U and R_E are the same.

3. Valuation

A. Discounted Cash Flow

-i- Model Setup and Assumptions

The DCF analysis of the project is based on the 28Oct2010 Tech Report; Table A in the Appendix 1 provides detailed references.

The 28Oct2010 Tech Report mentions sustaining capital expenditures, defined as capital expenditures post production, however it does not provide annual estimates for it. Using the pre-tax cash flow and working backwards, I have estimated the annual sustaining capital expenditures.

Table B in Appendix 1 details the list of assumptions used in the DCF model.

-ii- Analysis of the DCF Model: No Debt

I have used the Adjusted Present Value (APV) approach to analyze the projects free cash flow as this approach allows the decomposition of the overall net present value into its components. The APV formula is given by:

APV = $\sum FCF/(1+R_U)^n$ + PV(Debt Tax Shields) + PV(Capital Expenditure Tax Shields) + PV(Loss Carry Forward) + PV (other benefits) – PV(Bankruptcy costs) – PV (other costs); where

- FCF is the project free cash flows
- R_U is the unlevered cost of capital or asset risk

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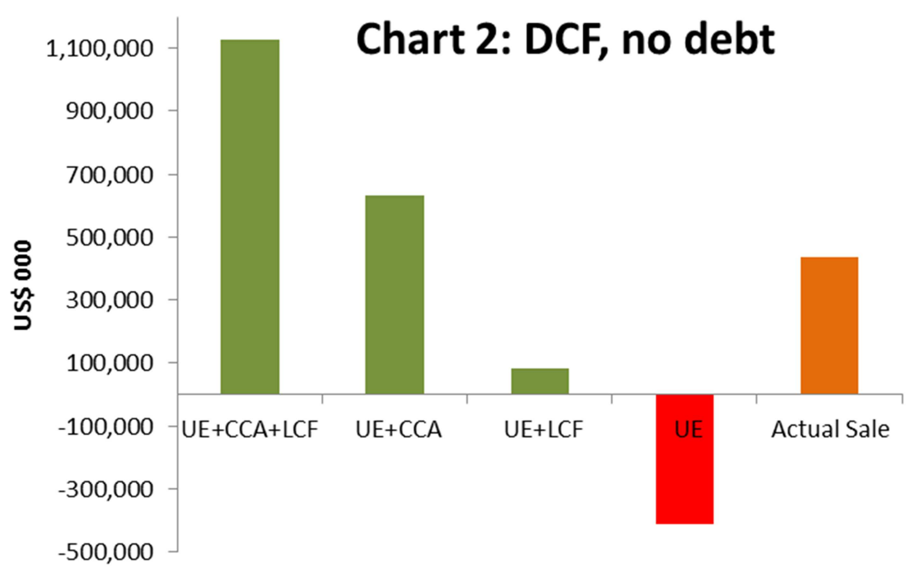
In this scenario it is assumed the Projects are financed 100% by equity; thus PV(Debt Tax Shields) = PV(Bankruptcy) = 0 and cost of equity = asset risk = project risk. Furthermore, the 28Oct2010 mentions in Section 18.11.2 Pre-tax Model that capital cost allowance is subject to a loss carry forward provision. Loss carry forward is valid for 20 years. However, although the loss carry forward provision is for 20 years making it highly probable that it will be exercised, it can only be exercised if the project produces positive taxable income. I have also assumed that once the project ends there would be no use of any loss carry forward accounts. Thus Pretium cannot benefit from the loss carry forward unless it can exercise this right during operations of the Projects. Moreover, capital tax shields follow the same rationale. Therefore, both of these benefits have a similar risk profile to that of the project and thus should be discounted at the unlevered cost of equity E_U.

Chart 2 below shows the estimated valuation of the Projects using DCF without debt (Table C in Appendix 1 shows a detailed summary of the estimates)



UE: Unlevered Equity, CCA: Capital Cost Allowance, LCF: Loss Carry Forward

Chart 2 shows that a significant portion of the DCF value is derived from the CCA tax shields and the effects of loss carry forward. Their impact is that significant primarily because in case of the CCA tax shields, the pre-operation capital expenditures are 100% amortized and in total the project capital expenditure generates almost US$ 5.8bn depreciable capital expenditure. In case of the loss carry forward, their impact is significant because the estimated loss carry forward generated of US$ 2.08bn are exercised within the first three years of operations. Without these benefits, it could be seen that the Projects would generate a negative NPV.

Although, Chart 2 shows that the project is overvalued relative to the acquisition price of CAD $450m; this overvaluation as will be shown below is highly sensitive to mineral prices estimates and the cost of unlevered equity.

Due to the long investment horizon of the project (30 years: 3 years development and 27 years of production) the cost of unlevered equity estimate will have a big impact on the valuation outcome. Chart 3 below show the sensitivity of the DCF model to changes in R_U (Table D in Appendix 1 shows the sensitivity model in more details).

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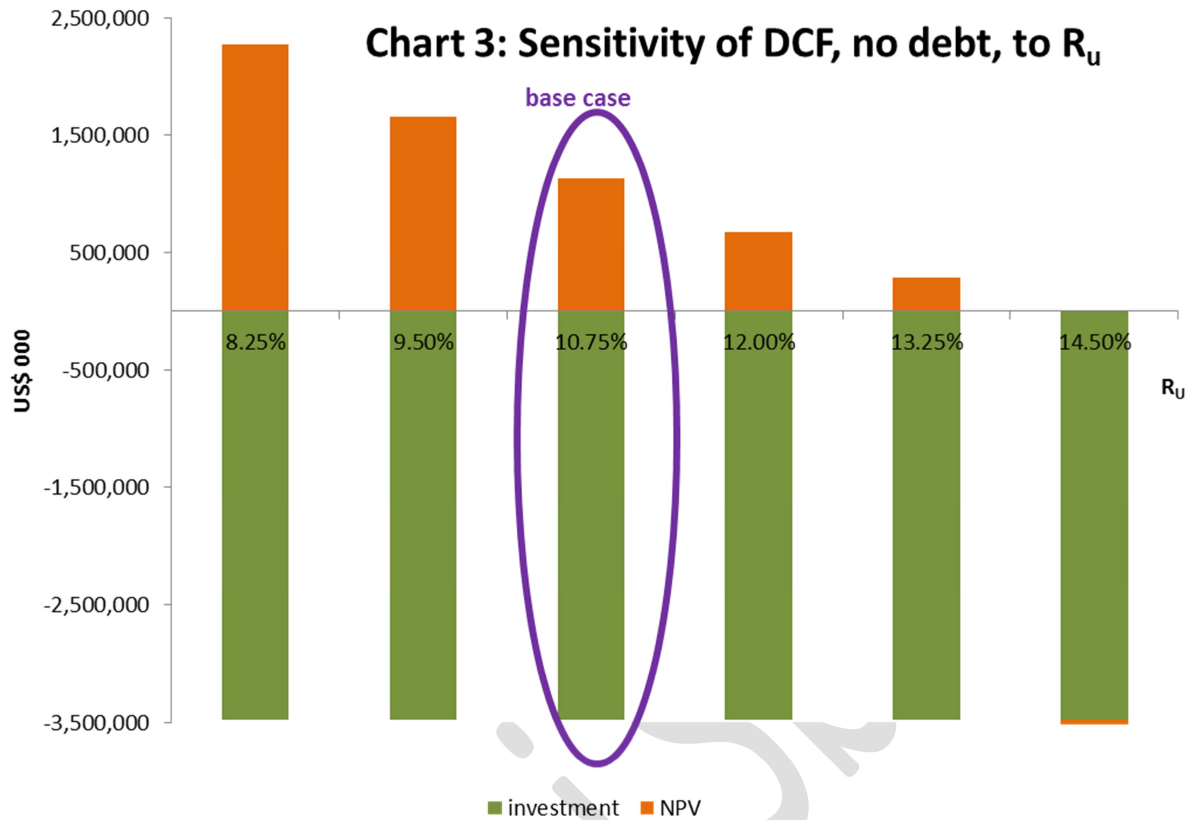
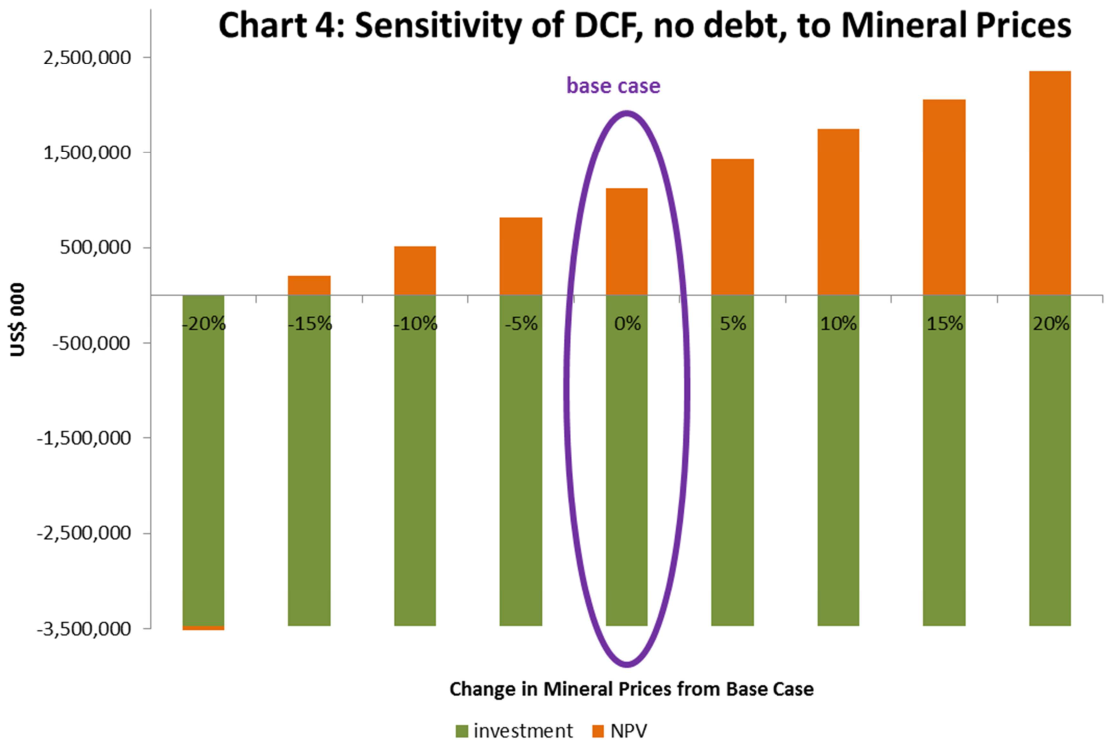


As can be seen, the DCF model is highly sensitive to the R_U, a mere 1.25% increase or decrease of R_U from base case will result in an estimated 67% reduction and 32% increase in value respectively.

Another value driver would be mineral prices. Unlike estimating variances, estimating mineral prices over long time horizons (30 years) is highly inaccurate; therefore I have assumed that mineral prices remain constant for the duration of the project. It uses end of 2010 prices as the base. This approach is also highly unpractical and thus to compensate for this shortcoming, I performed sensitivity and scenario analysis on mineral prices.

From Table 5, it can be seen that projects value is sensitive most to variation in gold prices &/or extractable quantities followed by copper, silver, rhenium and molybdenum. Chart 4 shows the sensitivity of the valuation to changes in overall prices of all minerals; i.e. all prices move up or down by a certain percentage (Table E in Appendix 1 shows this sensitivity in more details)



It can be seen that mineral prices have to drop collectively by 20% & 10% for this project to have a negative NPV or have a valuation close to the acquisition price of CAD $450m. On the other hand, a slight 5% increase in mineral prices will result in an estimated 27% increase in value. This shows that the project is as expected highly sensitive to the mineral prices.

-iii- Analysis of the DCF Model: Debt

Another method in which Pretium can raise the required capital to execute the Projects is by raising debt financing. Assuming that Pretium carries the same risk as its comparable Detour Gold, I have assumed that Pretium's cost of debt would be equal to that of Detour Gold, R_D = 3.94%. Furthermore, I have assumed that repayment of the debt (interest and principal) will commence after the first year of operation and the loan term will be equal to the Projects' expected life of 27 years.

The benefits of raising debt over raising equity lie in the value created by interest tax shields, thus increasing the enterprise value of Pretium. The downside of carrying on debt primarily lies in an increased potential of bankruptcy and associated costs.

I have analyzed two debt repayment scenarios: (1) bullet payment in which Pretium pays annual interest on the debt amount and one time principal payment at the end of the term and (2) amortized payment in which Pretium pays annual interest on the outstanding principal payment and annual portion of the principal.

The annual value created by interest tax shields is given by: Annual Interest Payments x Tax Rate, which are then discounted by the debt risk rate to compute the present value of the benefit of tax shields.

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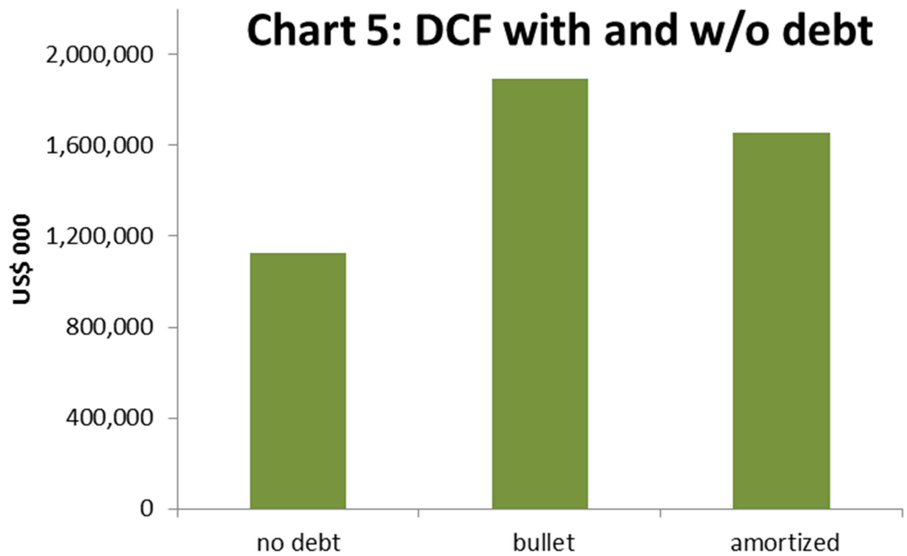
Chart 5 below provides a summary Pretium's enterprise value (Table F in Appendix 1 shows the summary in more details).



As can be seen the tax shields created via the bullet option are greater than that of the amortized option due to the nature of the interest payment profile over the life of the project. Under the bullet option, interest payment is constant over time while under the amortized option interest payment starts off at the same level as under the bullet option but decreases with time.

However, lenders face additional risk under the bullet method due to the substantial US$ 3.5 billion onetime payment at the end of the projects and thus might require a higher interest rate than that for the amortized option thus diminishing the difference between the tax shield benefits of the two options.

Moreover, the potential increase in bankruptcy costs and calculating their present value will eat into the tax shield benefits, thus the value of the Projects as depicted in Chart 5 represents the upper limit under the debt scenario.

Finally under the bullet option, the Debt to Equity ratio remains constant at 60% while under the amortization option the Debt to Equity starts off at 62% declining by time as more payments are made towards the principal are made thus freeing Pretium's debt capacity and enabling it raise more debt in the future.

B. Real Options

-i- Real Options vs Discounted Cash Flows

There are a number of conceptual differences between real options and discounted cash flow (DCF) methods that render real options the more appropriate choice for valuating investments that exist in uncertain conditions (e.g. physical projects: mines, power plants…etc). The major difference being that DCF analysis assumes that the investment is irreversible, that the cash flows will continue even if the project starts losing money or if it fails. While the DCF method is adequate where there is limited uncertainty or when projects are not actively managed, it robs managers from their option to delay, temporarily abandon, abort or react to changes while managing investments in uncertain environments or generally by being able to react to information. By actively managing investments, managers influence and alter future cash flows increasing positive cash flows and trying to limit negative or sub-optimal ones giving rise to asymmetry of returns as compared with DCF valuation. Thus expected returns are higher under options analysis as compared to DCF, better mimicking reality. This increase in valuation is mainly attributed to the asymmetry of returns, truncated low returns, achieved by active investment management.

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-ii- Real Options "on" and "in" Projects

In applying real options analysis to projects, one should distinguish between real options "on" and "in" projects. While both approaches value and exploit uncertainty and information gathering to create value, real options "on" projects portray technology and engineering design as black boxes, while real options “in” projects are created by changing the actual design of the technical system. Thus real options “on” projects are reactive to external variations e.g. extracting minerals only when price of such minerals make economic sense and abandoning such operations when it does not make economic sense. On the other hand, real options “in” projects are created by building in design flexibility to actively exploit and benefit from external variations e.g. designing a power plant to run on both natural gas and oil.

In the case of Snowfield and Brucejack projects, a real option “on” would be the variation in the prices of the underlying mineral deposits or variation in estimates of such deposits. While a real option “in” would be incorporating design features that would enable Pretium to vary its extraction method depending on the mineral deposits characteristics or by designing the processing plant to selectively process the most economical minerals while maintaining the option to process the others in the future.

-iii- Real Options “on” Snowfield and Brucejack at time of sale

A source of optionality and value creation “on” the projects would be the variability in both the mineral deposits estimates and their future prices. With the extensive drilling programs and statistical analysis, mineral deposit estimates would exhibit the highest variability in the early stages of pre-development decreasing with time. Therefore, in my analysis at the time of sale, I have assumed that prices variability is the most significant and dominant value driver. In isolating and assessing only the impact of prices of the underlying assets I will assume that the current operations design does not allow for the selective mining of minerals. Therefore, all minerals will be mined together. Thus the driver will not be price variation of minerals in isolation but rather price variation of the whole deposits, thus acting like a portfolio of minerals.

-iv- Option to Delay

Pretium management has the option to delay the extraction of the mineral deposits. In delaying the extraction of the deposits, Pretium will swap early cash flows for potentially larger future cash flows driven by an increase in mineral prices. Or in case mineral prices are not economical for developing the Projects, by delaying extraction Pretium management can avoid unfavorable cashflows. Another benefit would be the gain of knowledge / information about the mineral deposits and optimal extraction methods through additional drill programs. It can also benefit from mine technological advancements; however, this is more likely to materialize over long time horizons rather than a handful of years.

From this perspective the option to delay could be modeled as an indefinite American non-dividend paying call option. It is an indefinite American call option because for all practical purposes Pretium owns the mineral leases indefinitely and can exercise its right to extract the minerals at any time. Before commencement of operations, Pretium is required to sustain periodic exploration and development work prior to extraction to keep its mineral leases valid. While after commencement of operations, there would need to be an extended period of inactivity for Pretium to lose its mineral leases in any of the projects. It is a non-dividend paying option because although the company stands to forego cash flows in the near future it does so on the belief that the delay will produce even higher future cash flows big enough to compensate for the time value of money lost and then some. Therefore, this is fundamentally different from the dividend paying financial option in which it is expected that the value of the stock will decrease by the amount of dividend paid thus the cash flow lost during the option time period is lost for good.

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-a- Black-Scholes Options Pricing Model

Since Pretium's option to delay can be modeled as an American non-dividend paying option it is never optimal to exercise the option before its expiry. Therefore, for this special case the value of the American option is the same as that of a European option. Moreover, if we assume that for practical reasons (due to mobilization, drill test programs, permitting time requirements…etc) that the minimum delay period that Pretium can exercise is 1 year, then the Black-Scholes pricing model with a 1 year time interval can serve as a simple method to the value of the delay option at one year intervals.

The Black-Scholes pricing model for non-dividend paying European option is given by:

$C = SxN(d_1) – PV(K)xN(d_2)$; where

- C is the value of the call option (option to delay in this case)
- S is the value of the underlying asset (the mineral deposits in this case)
- K is the strike price (the capital expenditure in this case)
- $N(d_1)$ and $N(d_2)$ are the cumulative normal distribution that a normally distributed variable is less than d_1 and d_2 respectively
- T is the time period till expiry of option
- $d_1 = LN[S/PV(K) / \sigma(T)\char`^{0.5}$
- $d_2 = d_1 - \sigma(T)\char`^{0.5}$

Since the mineral deposits cannot be extracted instantaneously, their value has to take into consideration the time value of money. I have assumed that the practical and optimal time frame for extracting the deposits is the same as the estimated life of mine as reported in the 28Oct2010 Tech Report of 27 years.

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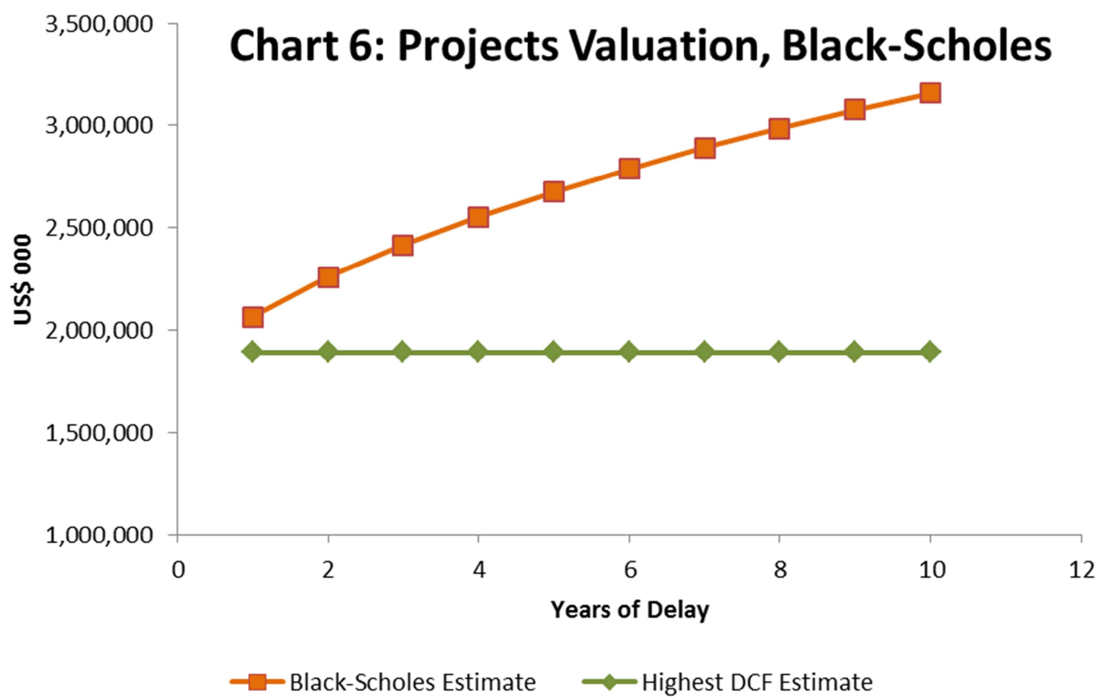
Subtracting the capital and sustaining expenditures from the estimated yearly free cash flows from the DCF model (hence why the operating expense do not form part of the strike price) and discounting at the cost of unlevered equity I have arrived at the value of the underlying asset of S = US$ 5.45 bn. Similarly discounting the capital and sustaining capital expenditures also at the cost of unlevered equity I have arrived at a strike price of K = US$ 3.43bn. This option is already in the money (which can also be viewed from the positive NPV calculated earlier), Pretium can undertake the project today and expect an NPV of US$ (5.45bn – 3.43bn) = US$ 2.02bn. But owing to the variability of the mineral prices, which I have used as the variability of the mineral portfolio of 14.67% as shown in Table 6 as a proxy, the value of the option will increase in time. Chart 6 shows a sample of values of the option to delay (Table G in Appendix 1 shows more details).



As predicted the value of the option increases with time due price variability of the underlying mineral deposits and time value of money.

-b- Binomial Option Pricing Tree

The binomial options valuation method assumes that for every period only two states exist, one where the value of the underlying assets (S) increases called the up-state and one where the value decreases called the down-state. Furthermore, since analysis of the returns of the minerals was based on Log returns, my model assumes that the up-state will be of the form e^{σ} and the down-state will be of the form $1/ e^{\sigma}$, where σ represents the standard deviation of the mineral portfolio. The underlying asset value (S) is the same as calculated in the previous section, while the strike price (K) is the same as in the previous section initially growing by the estimated inflation rate of 3% annually.

Furthermore, the replicating portfolio method was used to estimate the value of the delay option. The replicating portfolio is made up of the value of the underlying asset (S) and zero-coupon risk free bond.

For a simple 1 period binomial tree, the value of the option is given by:

- $C = S\Delta + B$
- $B = (C_d - S_d\Delta)/(1+r_f)$
- $\Delta = (C_u - C_d)/(S_u - S_d)$; where
    - C is the value of the call option, C_u and C_d are the values of the options in the up and down states respectively
    - C_u is given by max(S_u-Strike Price , 0)
    - C_d is given by max(S_d-Strike Price , 0)
    - B is the long (+ve) or short (-ve) position on the zero coupon bond
    - S is the value of the underlying asset, S_u and S_d are the values of the underlying assets in the up and down states respectively
    - r_f is the risk free rate

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Chart 7 shows the value of the delaying the production for up to 10 years using the binomial pricing model (Table H in Appendix 1 shows more details).

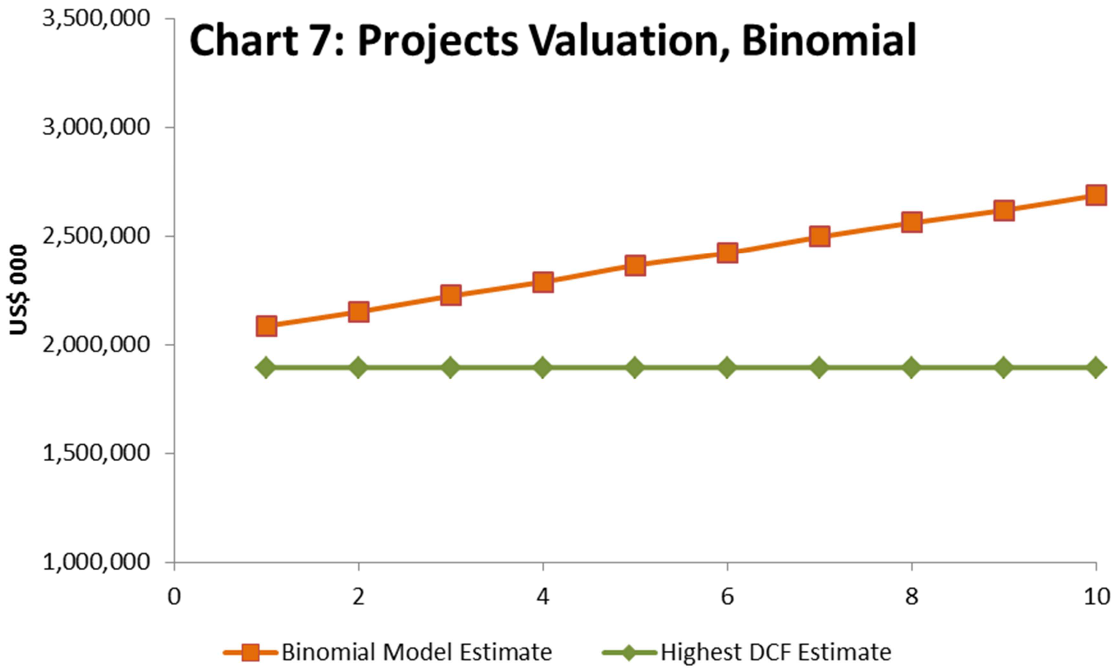
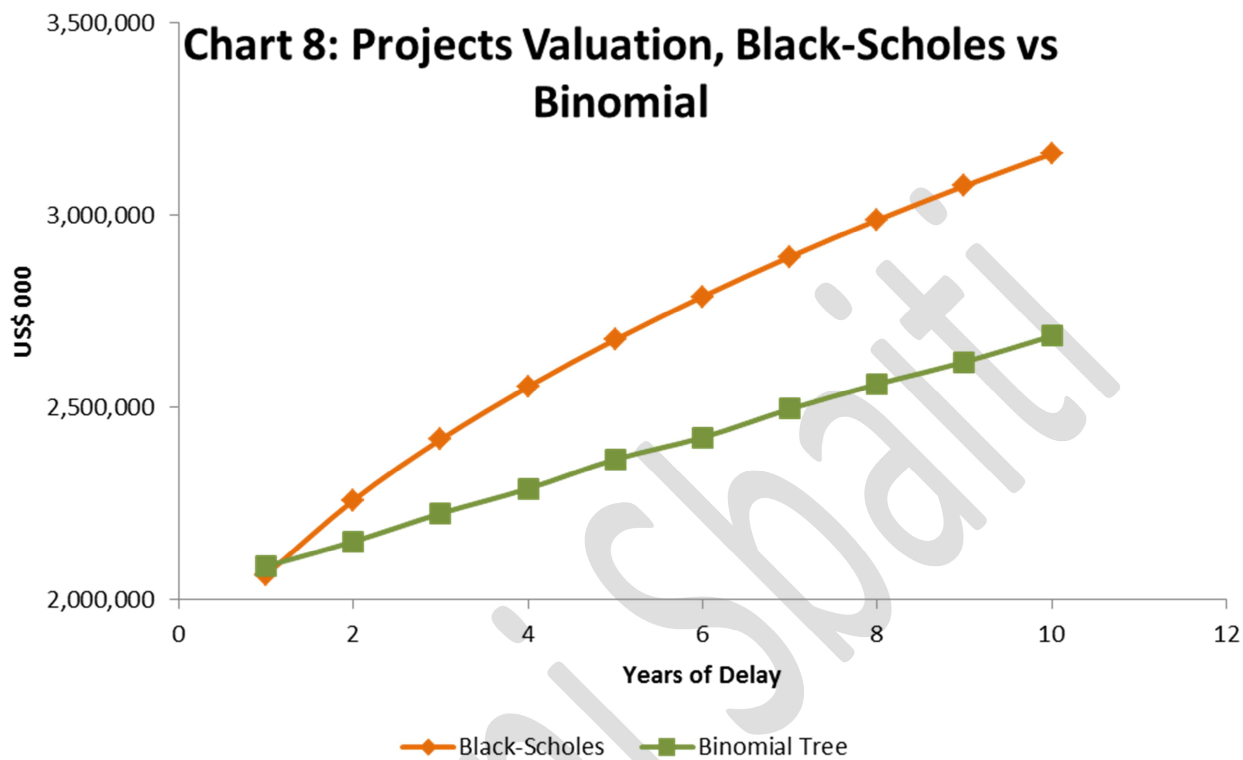


Chart 8 compares Charts 6 & 7.



Although Chart 8 shows that there are valuation differences depending on which pricing model is used, both Black-Scholes and the Binomial Option Pricing models follow similar trends over time. This appreciation in value stems from the expectation that mineral prices are up-ward trending through time.

It can be seen that the value of the option to delay for estimated used Black-Scholes and the binomial option pricing tree both increase with time. At the start both options are estimated comparably, with the Black-Scholes estimate increasing at a faster rate.

Appendix 2 incudes a sample calculation for a 5 year binomial option pricing model.

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-v- Real Options "in" Snowfield and Brucejack at time of sale

As mentioned earlier, real options "in" a project relates to the technology and design approaches employed to managing and exploiting future uncertainties. By designing "flexibility" in the system or the infrastructure required for future adaptation when required, managers will be in a position to extract additional value arising from uncertainty. This concept is similar to a power plant designed to run on both oil and gas. Normally a duel firing power plant would cost more to build for the same power output if it were built to run on either fuel exclusively. However, managers would be willing to spend that extra cost if it can offer them the flexibility to switch from one fuel source to other depending on their respective prices and thus offset the extra initial investment cost.

In the case of the Projects, a source of flexibility barring technical feasibility would be the extraction method (open pit vs underground) and related subcategories. This flexibility would be made useful in the efficient extraction of the mineral deposits based on their concentration and accessibility. It could also provide maneuvering room in case future technical studies showed mineral formations suitable more for one type of extraction than another.

Another source of flexibility would be the design of the processing plant. It is assumed by large that ore extraction cannot be exclusive to one mineral deposit, thus when extracting ore, one would expect deposits of at least two or more mineral types. However, when the ore is sent to the processing plant, depending on the design of the plant, operators may be able to selectively process specific mineral types. The reason for this selectivity depends on the underlying mineral prices at the time and on the net smelter returns. Furthermore, an additional source of flexibility would be if the operators are technically able to choose between concentrate types (dore vs copper concentrates which both include gold and silver). This flexibility would enable them to maximize the returns they receive from the smelter due to different contractual smelter return details per concentrate type and the underlying prices of the minerals.

by Hani Sbaiti

Due to the lack of operational cost details relating to each mineral deposit specifically in the 18Oct2010 Tech Report, I will only be able to lay out a general methodology that could be employed in quantifying the benefits of implementing such design and operating flexibility.

The underlying idea behind quantifying how much Pretium should be willing to spend to incorporate flexibility designs is to treat the minerals as independent uncorrelated assets and that the processing plant is capable of processing and concentrating the minerals selectively. The average operational expense needs to be broken down to average operational expense per mineral type; this will then form the strike price per mineral. The price of the underlying asset would simply be the underlying value of each mineral deposit. Finally, the estimated standard deviations of each mineral, the value drivers of the optionality were previously calculated in Table 2. Running the binomial option pricing model for the 5 minerals similarly as described in the previous section would represent an estimate of the value of the Projects.

Subtracting this estimate from the previously calculated options value net of the strike price for the same delay year would represent an estimate of how much the company should be willing to pay to incorporate design and infrastructure flexibility into its processing plant that would allow it to treat each mineral independently.

-vi- Value Created by Investing in Technical Studies since end of 2010

The 28Oct2010 Tech Report is based on exploring both the Snowfield and Brucejack mineral deposits. Future reports focused more on Brucejack as it was found that Brucejack contained larger concentrated estimates of gold and silver as was previously thought. This new shift in technical studies eventually culminated in Pretium focusing on exploiting the Brucejack mineral deposits instead of both Brucejack and Snowfield. Therefore, Pretium's management has exercised the option of gathering additional information and incorporated this new information into their decision analysis. The technical studies commissioned eventually affected the mineral estimates and the extraction method, thus impacting the estimated capital

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requirement and average operational expense. Therefore, the technical studies in essence affected the financial valuation of Brucejack. Applying the binomial option valuation method, one would be able to estimate how much the option to gather additional information would be valued at or in other words how much should Pretium be willing to pay for additional information.

In this case, the strike price at each node of the binomial tree would be the cost that Pretium would have to pay for the study and the payoff would be equivalent to how much more the project is valued at in light of the additional information gathered. Furthermore, it is important to note that each study is dependent on the results of its previous study. To value the overall value of the additional information one would have to discount the options value at each node to the present date. Some thought needs to go into selecting the appropriate discount rate. My rational suggests that the company's opportunity cost is the same as its cost of unlevered equity. This is because the company would otherwise invest that money in extracting the minerals today at a risk factor equivalent to its cost of unlevered equity since the company carries no debt at the current period.

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4. When to Exercise the Option

Given that the option to delay is similar to a non-dividend paying American call option which is never optimal to exercise before expiry, why would Pretium's management decide to go ahead in the development of the Brucejack mineral deposits?

As was seen earlier, the value of the Projects is highly sensitive to the price of the underlying minerals. Furthermore, even though historical data were used to estimate the future expected mineral prices, future expectations are highly subjective and inaccurate. Therefore, the management of Pretium might have decided to commence with the development of the Brucejack mine because they expect that the rate of appreciation of the prices of gold and silver, the main mineral deposits of Brucejack, will not be greater than that of the growth of the option to delay. It could also be that the company has a different future mineral price expectation that would render it optimal to commence development of the Brucejack mine.

5. Limitations of Analysis

As previously highlighted the valuation of the Projects is highly sensitive to a number of estimates: mineral prices & variation, mineral deposits, cost of unlevered equity and debt. Therefore, my above analysis and computations should be taken as the estimate they are. A valuation range would be more appropriate, where the range would depend on the main value drivers. Furthermore, the main goal of my analysis was to showcase the difference between employing discounted cash flow analysis and employing real options analysis and thus financial engineering products and analysis was not taken into consideration. For example, to manage price risk and to lock in mineral prices management could have hedged those risks by entering into futures or forward contracts for example.

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6. Conclusion

My analysis and this report shows that companies run the risk of undervaluing their investments should they rely solely on discounted cash flow valuation methods in environments that portray considerable uncertainty. The magnitude of undervaluation could be substantial and a number of magnitudes lower than valuation derived from real options analysis.

Furthermore, this higher valuation estimate stems from a different perspective of dealing with uncertainty and variations. Instead of trying to control and limit them, a company can exploit them and create additional value by being proactive in its management of risk and variations, building in the design flexibility (real options "in" a project) that would allow them to optimally steer their investment in light of future developments.

This approach could explain why at times managers would go ahead with projects that based on a DCF analysis would lose them money. Silver Standard opted to retain a substantial equity (slightly less than 50%) in Pretium at the time of the IP. Market signaling could be one possible explanation as to why Silver Standard retained such a significant ownership in Pretium. Another could be Silver Standard's expectation that Robert Quartermain, the current Pretium president and CEO and previous president and CEO of Silver Standard would increase the value of Pretium and thus increase the value of Silver Standard's equity in Pretium.

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Appendix-1

Table A: References to the 28Oct2010 Tech Report	
Table 16.32 Projected Metal Production – Snowfield and Brucejack	Page 16-47
Section 18.11.3 Smelter Terms	Page 18-133
Section 1.14 Capital Cost Estimate	Page 1-14
Table 18.29 Overall Operating Cost	Page 18-118
Section 18.11.2 Pre-tax Model	Page 18-130
Section 18.8 Taxes	Page 18-107

Table B: DCF List of Assumptions

Description	units	input	Remarks
Capital Cost Allowance (CCA)	%	25%	
Receivables % of Net Revenue	%	16.67%	60 days per year
Payables % of Annual Capex	%	16.67%	60 days per year
grams to pounds		2.20E-03	
pounds to grams		453.59	
grams to Oz		0.032	
Federal Taxes - Corporate	%	15%	on taxable income
Provincial Taxes - Corporate	%	10%	on taxable income
Provincial Taxes - Mining	%	2%	On Net Revenue - Operating Expense
Provincial Taxes - Mining	%	13%	On Taxable Income
Average Operating Cost	US$	9.38	per ton milled
Riskiness of CCA	%	10.75%	
Cost of Unlevered Equity	%	10.75%	
Inflation	%	3%	

Table C: Projects DCF Valuation (US$ 000) - Without Debt

Component	Value	Project NPV	% of Value
Required Investment	3,479,291		
Value of Unlevered Equity including CCA and Loss Carry Forward	4,608,031	1,128,740	
Value of Unlevered Equity without Loss Carry Forward	4,112,948	633,657	
Value of Unlevered Equity without CCA	3,560,764	81,473	
Value of Loss Carry Forward	495,082		44%
Value of CCA	1,047,267		93%

CCA: Capital Cost Allowance

Table D: Sensitivity of Project NPV to Cost of Unlevered Equity R_U - DCF no debt

Component						
R_U	8.25%	9.50%	10.75%	12.00%	13.25%	14.50%
Required Investment	3,479,291	3,479,291	3,479,291	3,479,291	3,479,291	3,479,291
Value of Unlevered Equity including CCA and Loss Carry Forward	5,754,959	5,134,846	4,608,031	4,156,776	3,767,293	3,428,759
Value of Unlevered Equity without Loss Carry Forward	5,199,220	4,610,500	4,112,948	3,688,997	3,325,008	3,010,299
Value of Unlevered Equity without CCA	4,545,829	4,011,785	3,560,764	3,176,945	2,847,988	2,564,186
Value of Loss Carry Forward	555,738	524,346	495,082	467,779	442,285	418,459
Value of CCA	1,209,130	1,123,060	1,047,267	979,832	919,305	864,573
Project NPV including CCA and Loss Carry Forward	2,275,668	1,655,555	1,128,740	677,485	288,002	-50,532
Percent Deviation from Base Case	50.40%	31.82%	0.00%	-66.61%	-291.92%	2333.70%

Table E: Sensitivity of Project NPV to Mineral Prices - DCF no debt

Mineral Prices Variation	-20.00%	-15.00%	-10.00%	-5.00%	0.00%	5.00%	10.00%	15.00%	20.00%
Component									
Required Investment	3,479,291	3,479,291	3,479,291	3,479,291	3,479,291	3,479,291	3,479,291	3,479,291	3,479,291
Value of Unlevered Equity including CCA and Loss Carry Forward	3,369,123	3,683,340	3,991,692	4,299,861	4,608,031	4,916,200	5,224,370	5,532,539	5,836,641
Project NPV	-110,168	204,049	512,401	820,570	1,128,740	1,436,909	1,745,079	2,053,248	2,357,350
Percent Deviation from Base Case	-110%	-82%	-55%	-27%	0%	27%	55%	82%	109%

Table F: Projects DCF Valuation (US$ 000) - with Debt

Component	Value	Project NPV
Required Investment	3,479,291	
Value of Unlevered Equity including CCA and Loss Carry Forward	4,608,031	1,128,740
Bullet Payment		
Value of Tax Shields Generated	764,385	
Value of Levered Equity including CCA and Loss Carry Forward	5,372,416	1,893,125
Amortized Payment		
Value of Tax Shields Generated	527,111	
Value of Levered Equity including CCA and Loss Carry Forward	5,135,141	1,655,850

CCA: Capital Cost Allowance

Table G: Black-Scholes Option Pricing Model - non-dividend paying

US$ 000

Value of Underlying Assets	5,451,492				
Strike Price	3,429,785				
Delay Years	1	2	3	4	5
d1	0.94	0.93	0.93	0.94	0.95
N(d1)	0.83	0.82	0.82	0.83	0.83
d2	0.55	0.39	0.27	0.17	0.09
N(d2)	0.71	0.65	0.61	0.57	0.54
Value of Option to Delay	2,064,818	2,257,778	2,415,717	2,553,115	2,676,050

Delay Years	6	7	8	9	10
d1	0.96	0.97	0.98	0.99	1.00
N(d1)	0.83	0.83	0.84	0.84	0.84
d2	0.02	-0.05	-0.11	-0.16	-0.21
N(d2)	0.51	0.48	0.46	0.44	0.42
Value of Option to Delay	2,787,878	2,890,732	2,986,088	3,075,032	3,158,396

Table H: Binomial Pricing Model - non-dividend paying
US$ 000

Value of Underlying Assets	5,451,492				
Risk free (r_f)	3%				
inflation rate	3%				
Dealy Years	**1**	**2**	**3**	**4**	**5**
Strike Price	3,532,679	3,638,659	3,747,819	3,860,254	3,976,061
Value of Option to Delay	2,021,707	2,021,707	2,039,517	2,047,986	2,080,384

Dealy Years	**6**	**7**	**8**	**9**	**10**
Strike Price	4,095,343	4,218,203	4,344,749	4,475,092	4,609,345
Value of Option to Delay	2,083,233	2,121,750	2,143,382	2,159,212	2,194,345

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Appendix-2

5 year binomial option pricing model

Model Inputs

Description	Units	Value
Portfolio Expected SD	%	14.67%
up state (e^{σ})	n/a	1.16
down state $1/e^{\sigma}$	n/a	0.86
Value of Underlying Assets (S)	US$ 000	5,451,492
Strike price (K)	US$ 000	3,429,785
Risk Free	%	3%
inflation rate		3%
Call option		$= S\Delta + B$
Δ		$= (C_u - C_d)/(S_u - S_d)$
B		$= (C_d - S_d\Delta)/(1+r_f)$

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Vlaues in US$ 000

period	0	1	2	3	4	5
strike price	3,429,785	3,532,679	3,638,659	3,747,819	3,860,254	3,976,061
assumed risk free	3%	3%	3%	3%	3%	3%

							Option Value
						11,350,403	7,374,342
					9,801,942		
				8,464,727		8,464,727	4,488,665
			7,309,939		7,309,939		
		6,312,692		6,312,692		6,312,692	2,336,630
asset value	5,451,492		5,451,492		5,451,492		
		4,707,781		4,707,781		4,707,781	731,719
			4,065,529		4,065,529		
				3,510,895		3,510,895	0
					3,031,926		
						2,618,300	0

					5,941,688
				4,716,908	
			3,671,280		3,449,685
		2,794,770		2,564,873	
option value	2,080,384		1,847,800		1,591,239
		1,294,943		1,042,815	
			665,355		401,593
				220,408	
					0

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					1.00
				1.00	
			1.00		1.00
		0.98		1.00	
Δ	0.93		0.95		1.00
		0.85		0.86	
			0.69		0.61
				0.39	
					0.00

					-3,860,254
				-3,747,819	
			-3,638,659		-3,860,254
		-3,399,145		-3,747,819	
B	-3,014,164		-3,322,257		-3,860,254
		-2,721,538		-2,998,120	
			-2,128,162		-2,083,879
				-1,143,706	
					0

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