THOUGHT PIECE

Using Dynamic Financial Modeling to Enhance Insights From Financial Reports!

Valuing natural resources projects, and companies, has been made easier by the provision of significantly more public data – the availability of bankable feasibility studies is a good example of this. But do these reports actually help investors as they only provide a static financial representation of the project being evaluated? What other financial tools can investors use to better understand the full range of potential outcomes for a project given the inherent probabilities and correlations involved?

Relevant Natural Resources Industries – Mining & Metals, Oil & Gas

17 JANUARY, 2022

By Lachlan Hughson

Founder, 4-D Resources Advisory LLC

4-D RESOURCES
ADVISORY LLC

Value Accretive Insights for Resources Executives and Investors

+1-917-783-8833 | lachlan@4-DResourcesAdvisory.com | 4-DResourcesAdvisory.com

Correctly valuing natural resources projects, and companies, is critical to the efficient allocation of capital to assets that will deliver the returns risk-averse bond and equity holders require. This is especially the case where capital access is constrained by investors who have not been adequately rewarded historically for their previous investments – which is the unfortunate reality for both the mining and the energy industries over time. The difficulty of accessing capital by today's mining and energy companies is a good example of how consistently poor returns will impact the industries' ability to grow with the support of open-minded, positively focused investors and capital markets.

With the plethora of financial documents now filed across both northern and southern hemisphere exchanges, especially those that contain a project valuation such as included in an NI-43-101 filing for Canadian mining companies, investors should presumably be able to make better decisions. However, this data, and the models that generate it, only provide a snapshot into one potential outcome (i.e. a static model) for the most expected (or desired) result, while ignoring all other potential outcomes. Additionally, the sensitivity analysis typically provided only shows how value changes for a change in one variable, thus intrinsically assuming all variables are independent. This is a fallacy – production, operating costs, capital costs and risk are all inherently related/correlated to changes in the commodity price and the exchange rate underlying the project. As they are also to each other.

Which raises the critical question – how do we as executives and investors use the public information contained in the financial projections, and related data provided in a technical report, the most data filled report typically provided by a company, to create a more comprehensive financial model of the project to understand its range of potential outcomes. One that will also help us to better understand the variability of those outcomes (i.e. the risk of the project).

For a more detailed discussion of the benefits of a dynamic/probabilistic approach to financial modeling versus the more traditional static/deterministic approach, please read my Thought Piece dated 5 October, 2021 entitled *Natural Resources Financial Modeling and How to Make It Better!* per 4-dresourcesadvisory.com/natural-resources-financial-modeling-and-how-to-make-it-better/

The best, and primary, way to achieve a better financial understanding is through building a dynamic financial model using a probabilistic software such as @RISK. And using the data within the technical report to provide the input variable parameters required. Best of all, it is an easier process than maybe expected as the example below will illustrate.

For this example I will use the NI-43-101 report for an arbitrary gold mining company. The project is this company's only asset so that allows a relatively easy comparison of values to the company's share price. I made balanced changes to certain inputs to ensure this analysis cannot be attributed to a specific company as that is not the purpose of this Thought Piece.

The project description is set out in Figure 1 below.

Figure 1:

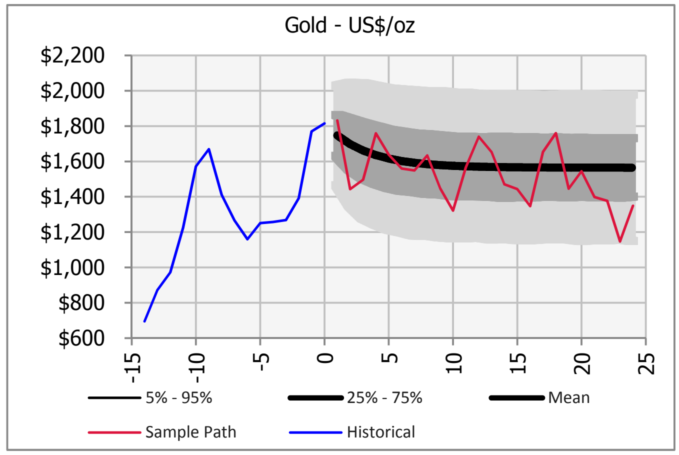
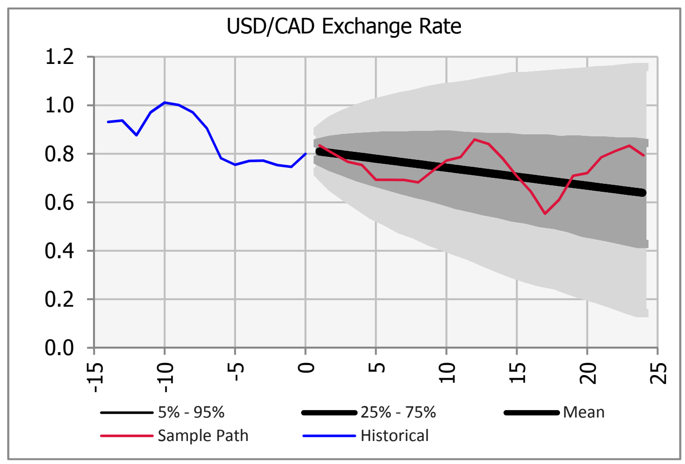
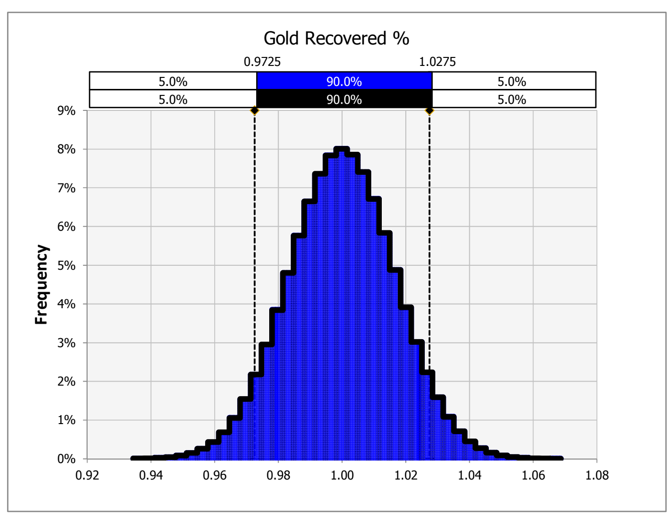
Project Description per NI-43-101 Technical Report for Feasibility Study
• Proposed North American based gold mine in a reasonably developed area • Project based on an approx. 20 year mine life • Competent management with track record of delivering similar precious metal projects • Comprehensive data provided in technical report for data inputs and risk/variability assumptions • Technical report financial data used to calculate the A-T (after-tax) Project NPV and IRR - Includes annual commodity price, exchange rate, production, operating costs, capital costs and tax payment data over the life of the project

The financial model output provided in the technical report only showed one potential outcome despite there being a wide range of potential outcomes given the uncertainty associated with each variable, especially the commodity price and the exchange rate. **To enhance the value of this static model approach, the data can be used to build a dynamic financial model (using the @RISK software here) whose output will provide far greater insight into the variability of the project valuation and returns, and what this means for the share price of the company developing the project.**

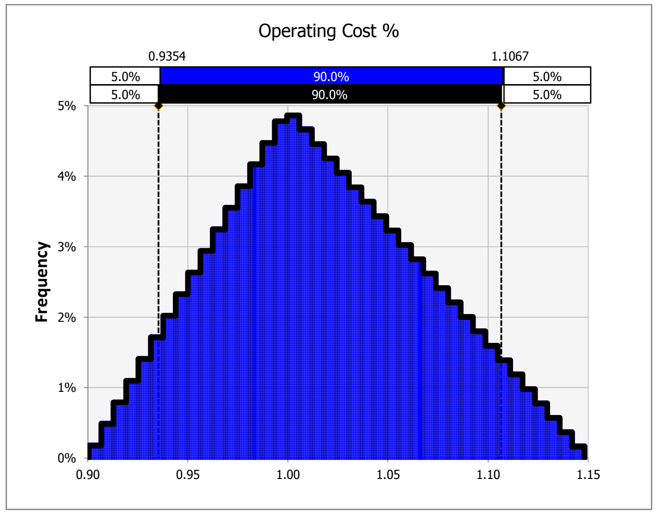
In order to develop a dynamic financial model, first the input variables need to be calculated based off the data in the NI-43-101 document and appropriate distribution assumptions. The input variables for the dynamic model are highlighted in Figure 2 below along with the underlying assumptions.

This is a simplified example to illustrate the logic behind a dynamic approach to financing modeling, however one can test many more input variables in greater detail than shown below.

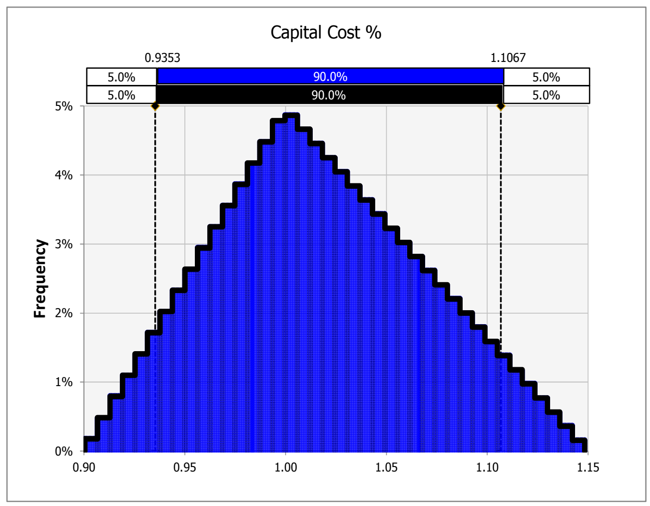
Figure 2:

<table>
<tr><th>Inputs & Assumptions</th><th>Distribution Used</th></tr>
<tr><td>Gold Price (US/oz) – Projected using a time-series distribution through the life of the project based on the 15 year historical gold price performance from 2007-2021. Each iteration of the model will generate a new annual price projection for the ≈20 year life of the mine, with each estimate related to but different from the previous.</td><td>
</td></tr>
<tr><td>USD/CAD Exchange Rate – Projected using a time-series distribution through the life of the project based on the 15 year historical USD/CAD exchange rate from 2007-2021. Each iteration of the model will generate a new annual exchange rate projection for the ≈20 year life of the mine, with each estimate related to but different from the previous.</td><td>
</td></tr>
<tr><td>Production – Projected using a normal distribution of +/- 5% applied to production data (i.e. Mean of 1.0 and St. Dev. of 0.0167 so 3 standard deviations = 5%). There will be variability in the production profile so a +/- 5% factor is applied. The 1 factor (i.e. 100%) reflects the static data directly from the feasibility study.</td><td>
</td></tr>
</table>

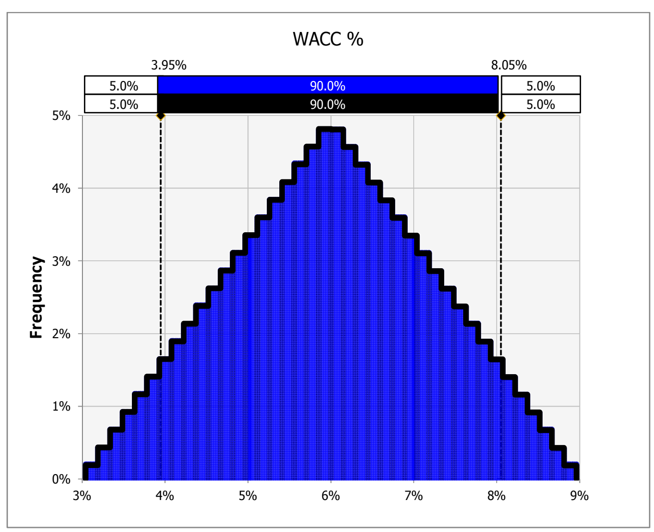
Operating Cost – Projected using a *triangular distribution* of -10%/+15%, given limits of feasibility study, applied to operating cost data. This cost adjustment factor reflects the underlying variability associated with cost estimates in a feasibility study. The 1 factor (i.e. 100%) reflects the static data directly from the feasibility study.



Capital Cost – Projected using a *triangular distribution* of -10%/+15%, given limits of feasibility study, applied to capital cost data. This cost adjustment factor reflects the underlying variability associated with cost estimates in a feasibility study. The 1 factor (i.e. 100%) reflects the static data directly from the feasibility study.



WACC – Discount rate projected using a *triangular distribution* of 3% - 9% (based on a 6% midpoint) assuming Requity of ≈9% and Rdebt of ≈5% (tax rate @ 30%) and 50/50 split for equity and debt. Lower bound set by WACC approaching Rfree for all inputs at low end of range (i.e. low risk outcomes) and higher bound set at 100% equity cost (high risk outcomes).



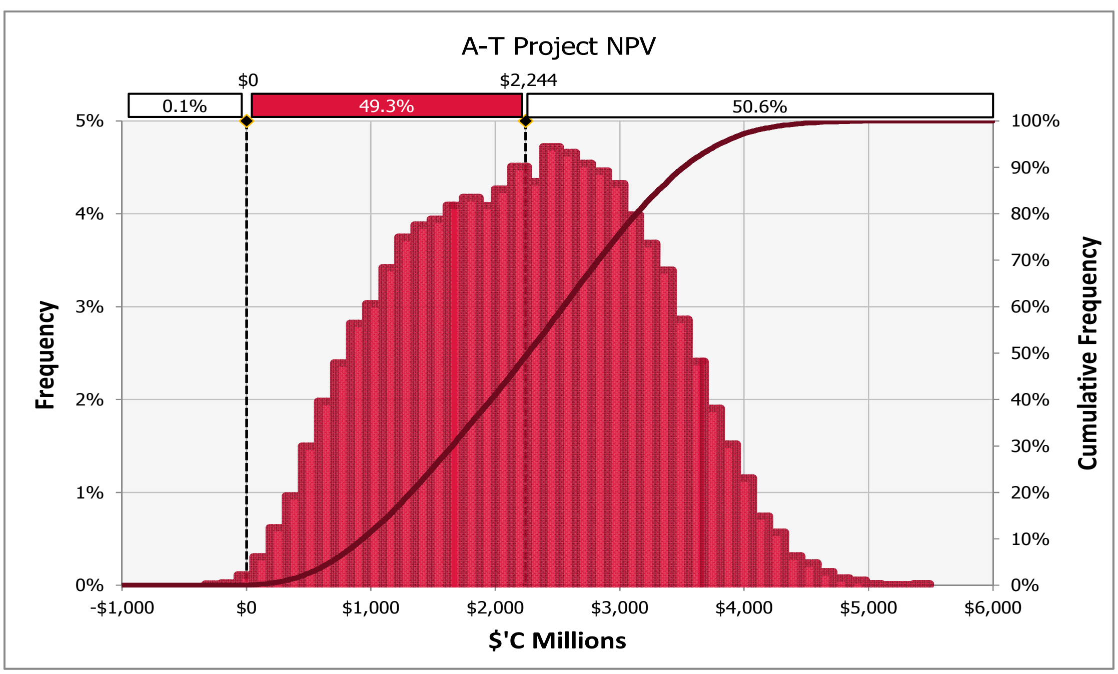
Correlation Coefficients – Positive for USD gold price vs. production, opex and capex as these generally move in the same direction, albeit with a time lag, and negative for the exchange rate vs. opex and capex as input prices are in USD. Positive for exchange rate vs. USD gold price and production as a weaker USD increases USD gold price and production, albeit with a lag.

@RISK Copula: Copula1	Gold Price	Exch. Rate	Rec. Gold	Opex	Capex
Type	Gaussian				
Gold Price	1.000	0.511	0.613	0.511	0.511
Exch. Rate	0.511	1.000	0.341	-0.341	-0.341
Rec. Gold	0.613	0.341	1.000	0.341	0.341
Opex	0.511	-0.341	0.341	1.000	0.511
Capex	0.511	-0.341	0.341	0.511	1.000

Using the distribution profiles for the primary input variables, based off the single data estimates of the same variables in the NI-43-101 report, the dynamic financial model is set up to allow the user to gain a much better understanding of what the full range of potential outcomes will be for the answers sought – in this case, the A-T Project NPV and the A-T Project IRR. The model output distribution for the A-T Project NPV is shown in Figure 3 below, for 33,200 iterations; the number required for a convergence confidence interval of 99% for the mean and standard deviation of the values calculated.

Figure 3:

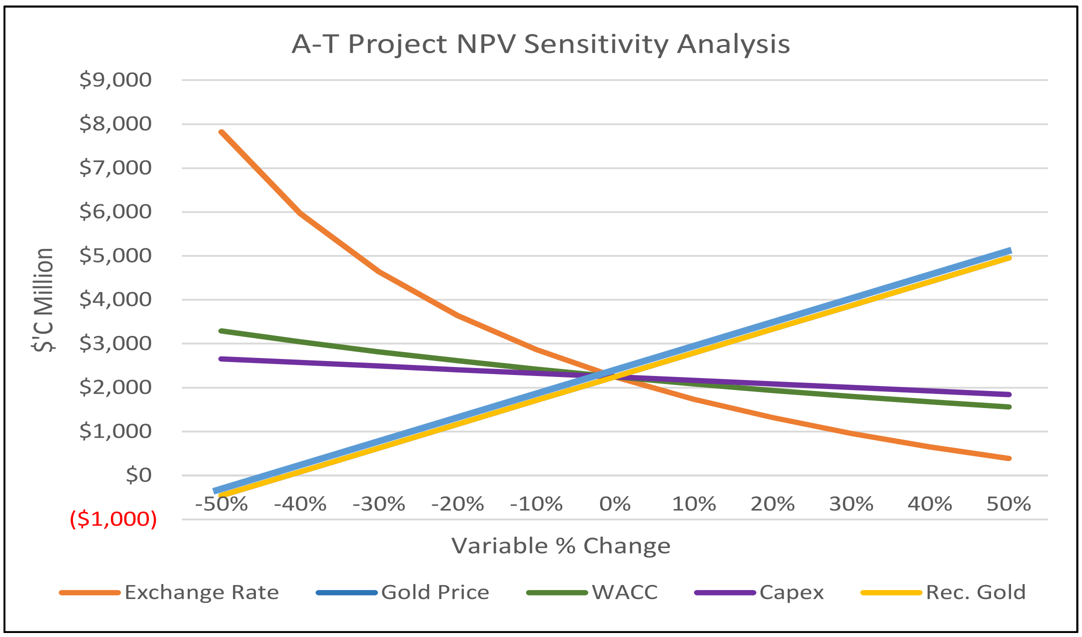
A-T Project NPV Distribution Profile – Dynamic Model



What can we learn from this? The static model valuation, using the single gold price projection along with the inputs from the NI-43-101 report, results in an A-T Project NPV of $'C 2,300 million for this gold project. The dynamic model, with the input variables instead included as a distribution of potential ranges with a correlation matrix, shows a median value of $'C 2,244 million with a potential 1%/99% range of $'C 307 million to $'C 4,299 million – a range of $'C 3,992 million. Compared to the value range shown from the typical static model sensitivity analysis in Figure 4 below, which suggests a potential value range of $'C 7,825 million to $'C -459 million – a range of S'C 8,284 million – a dynamic modeling approach provides a greater degree of insight into what the potential range of outcomes could be. This reflects both the realistic correlation between the dependent variables and the low probability associated with the extreme end of each of the input variables, which is not intrinsically quantified in a static sensitivity analysis.

Figure 4:

A-T Project NPV Sensitivity Profile – Static Model (Presented in an NI-43-101 Technical Report)

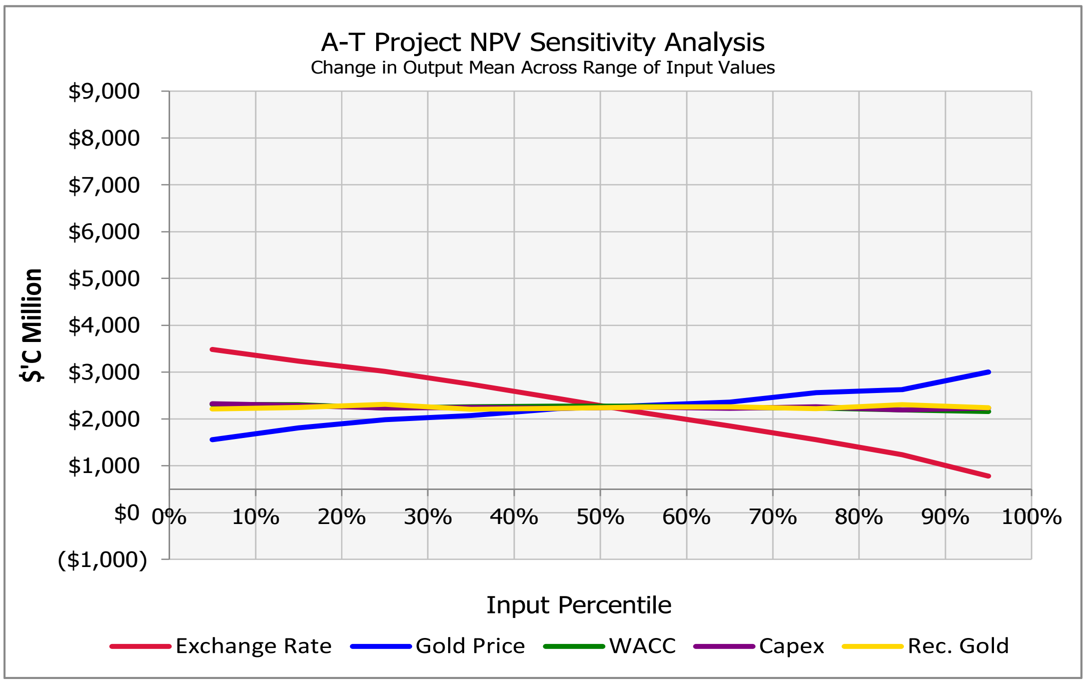


A dynamic financial model can also generate a sensitivity analysis – using a Spider Chart – which does the same thing as the graph above, except it includes the correlations between the input variables along with the distribution assumptions for each variable. This allows for a more reasonable sensitivity analysis than just assuming -50% to +50% change in each variable (at 10% increments) without a reason why. Per the

Spider Chart in Figure 5 below, with the minimum and maximum graph values set at the 5% and 95% A-T Project NPV values, it highlights how less the sensitivity actually is compared to the static Sensitivity Analysis in Figure 4 above. Plus it highlights that while the project value changes are primarily driven by the USD gold price and the USD/CAD exchange rate, the sensitivity is actually far less than the conventional, static graph shows. Additionally, it shows production changes have less of an affect than what the simple, static Sensitivity Analysis shows.

Figure 5:

A-T Project NPV Sensitivity Profile – Dynamic Model

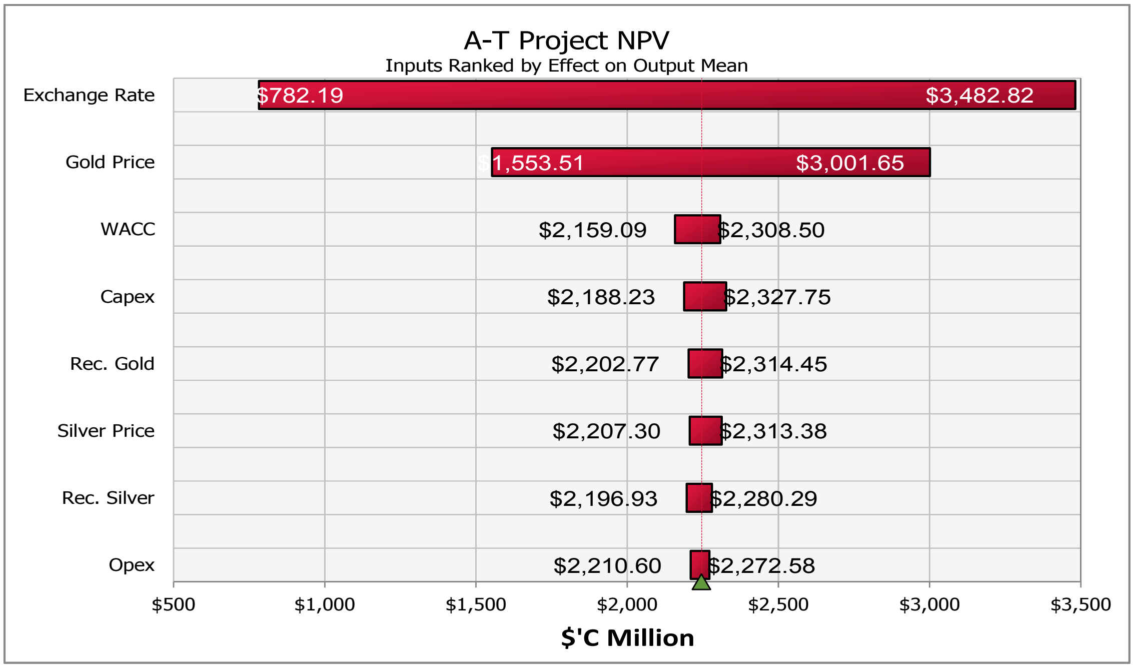


The data from a dynamic Sensitivity Analysis can also be shown in a Tornado Graph form, per Figure 6 below, which synchronizes with the Sensitivity Table in Figure 5 above. This ranks the input variables in order of importance with respect to the changes in value for the A-T Project NPV and shows the ranges of the end values resulting from 5%/95% confidence interval.

One can also examine the probabilistic distributions for outcomes such as payback period, annual gold production, unit cash costs, operating margins and leverage ratios to fully understand the probabilities associated with not meeting operational or financial covenants.

Figure 6:

A-T Project NPV Tornado Graph – Dynamic Model



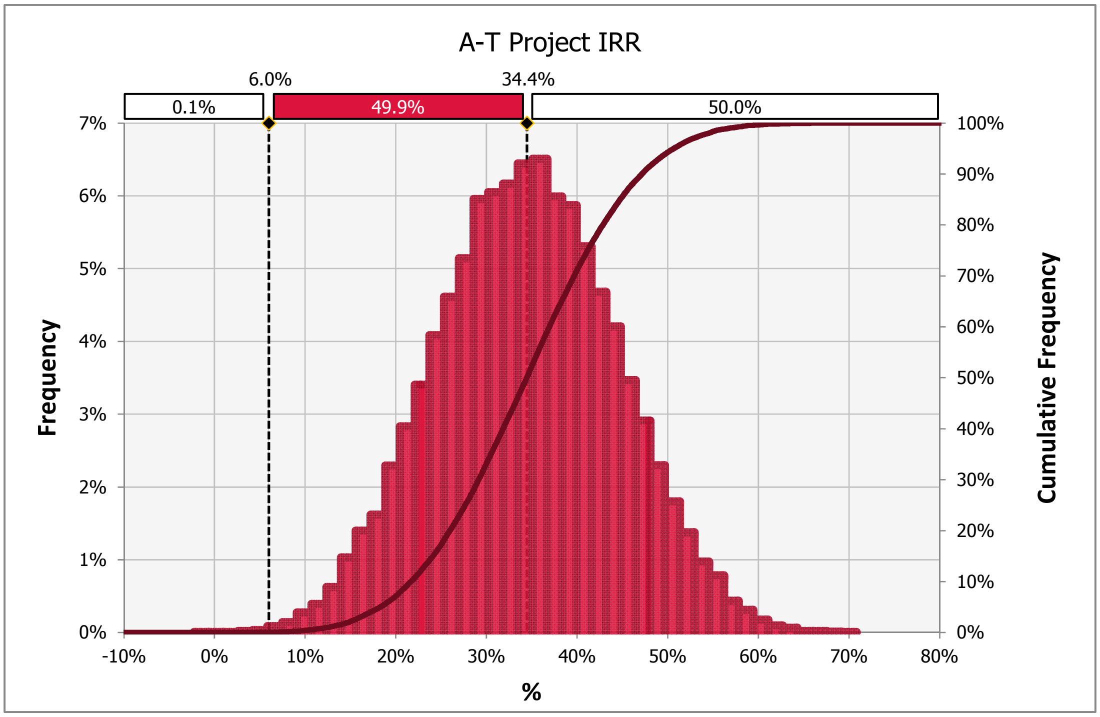
The other important aspect of a dynamic analysis is that it gives a real sense of project risk that a simple calculation of a discount rate does not. It highlights the probability that the project will earn its required cost of capital in a way a static model does not. This gives management more insight into the actual risk to the company of an investment in this project.

As set out in Figure 7 below, a dynamic model is also used to calculate the A-T Project IRR with the same degree of insight provided through a probabilistic output. This analysis suggests the project will return a median IRR of 34.4%, relative to the average WACC of 6% required, and it highlights how robust the project is with only a 0.1% probability the WACC is not achieved. Given the minimum positive projected NPV, supported through the IRR that is significantly greater than the required rate of return, it certainly appears this project is robust and worth the capital required to fund its development.

This analysis should also allow debt and equity investors to become more comfortable with their risk, and be able to trust more in the operating and financial assumptions used, as they are less open to conscious or unconscious biases or mistakes (i.e. strategic misrepresentation).

Figure 7:

A-T Project IRR Distribution Profile – Dynamic Model



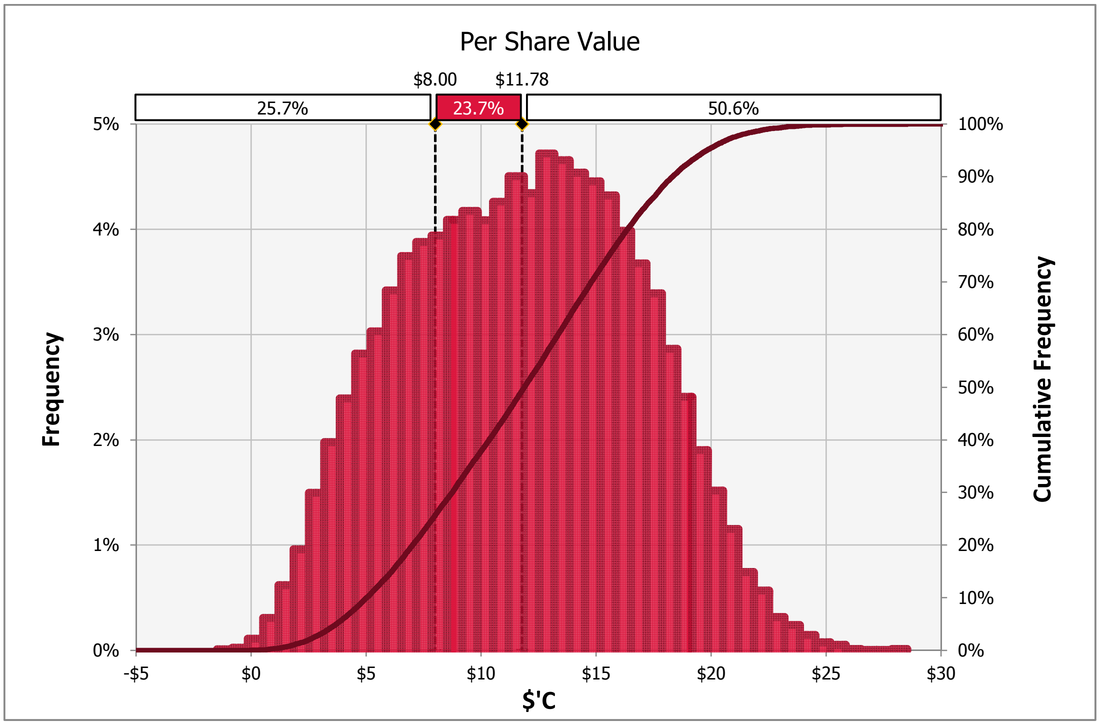
The final part of this analysis considers how the project could impact the share price – a critical part of the decision making process for the investment in this project. Using the latest balance sheet data, and assuming the present value of debt financing used for the project, the equity value was able to be calculated using the same dynamic modeling approach used for the project valuation. Per Figure 8 below, the per share value range is shown compared to an assumed current share price of $'C 8.00.

This analysis calculates there is a 74.3% probability the development of this project will increase the value of the company's share price, with a median projected price of $'C $11.78 indicating a 50% probability of a 47% return from the current price.

Such an analysis provides significantly more detail than simply using a trading multiples approach for expected value accretion from this investment, and gives investors more insight into the potential price appreciation risk/return matrix depending on their own risk profile.

Figure 8:

Per Share Distribution Profile – Dynamic Model



CONCLUSION

In the relatively simple example above, using public data that is available for many natural resources projects and companies, a dynamic modeling approach provides a more real world calculation of both the A-T Project NPV and IRR, and company per share value, through using input variables and correlation assumptions that reflect projected reality rather than single data estimates that tend towards the most expected value, assuming no strategic misrepresentation.

Additionally, the output data provides greater insight into the variability of outcomes than the static model single data estimates could, and provides far more insight and quantitative discipline than a simple individual variable based sensitivity analysis. Company management can then use the more detailed information to define which project parameters are higher risk, and hence warrant further study and expenditures. And it allows them to focus on mitigation strategies to more effectively manage downside risk while leveraging upside potential.

And the model took less time to build, with less internal relationships to create to make the output trustworthy, given input variables and correlation were set using the @RISK software options. This dynamic modeling approach can be used for all types of financial models.

With @RISK modeling software used by 97% of Fortune 100 companies, and countless Fortune 500 companies, it further highlights how especially useful it can be for smaller and mid-sized companies who have to make the most of the decision making capacity of their smaller finance departments.

Lachlan Hughson, the Founder of 4-D Resources Advisory LLC, has a 30+ year career in the oil/gas and mining/metals industries as an investment banker and a corporate executive. He has undertaken $30+ billion of M&A and $15+ billion of capital raising assignments during his career. His commercial experience is further enhanced through a Master of Business degree from the University of Technology Sydney, Australia, a Master of Business Administration degree from the Kellogg School of Management, Northwestern University, U.S.A., and a Master of Science degree, with Distinction, from the Royal School of Mines at Imperial College London.

4-D RESOURCES
ADVISORY LLC

Value Accretive Insights for Resources Executives and Investors

+1-917-783-8833 | lachlan@4-DResourcesAdvisory.com | 4-DResourcesAdvisory.com

4-D Resources Advisory LLC is a boutique financial advisory firm that utilizes probabilistic-based financial models to enable executives and investors in the oil/gas and mining/metals industries to enhance their decision making process. Its genesis was the realization by its founder, Lachlan Hughson, that the natural resources industries are not well served by complex, static financial models but instead require a dynamic approach given the complexity and interrelationships of the primary variables driving the value creation process. If the geoscience and engineering departments rely on probabilistic software and models, and the enhanced insights gained from their output, shouldn't the finance function utilize the same approach to their work?