Understanding the capital efficiency and risk effects of a streaming deal

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EY Valuation and Business Modelling
Complex Securities Group

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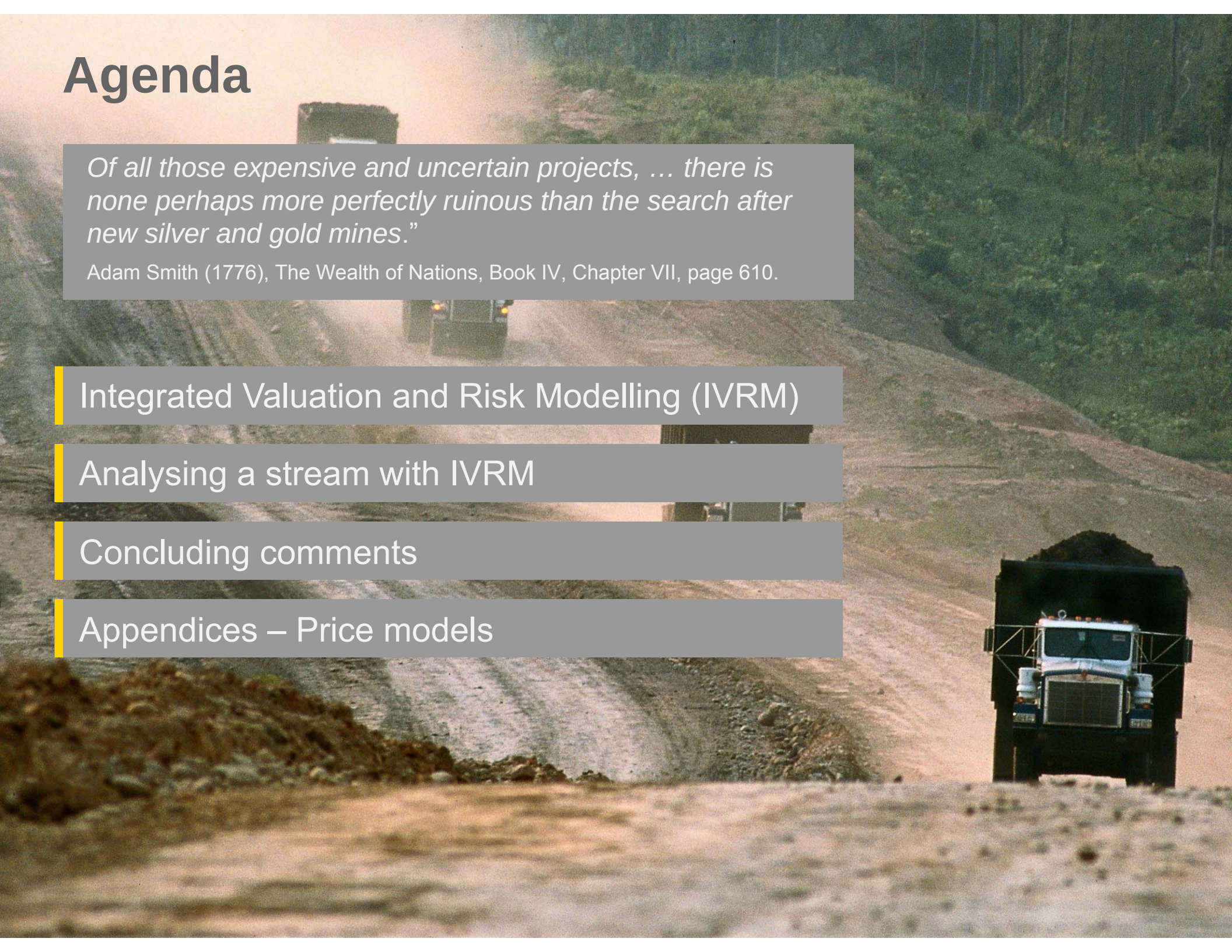
Building a better working world

Agenda

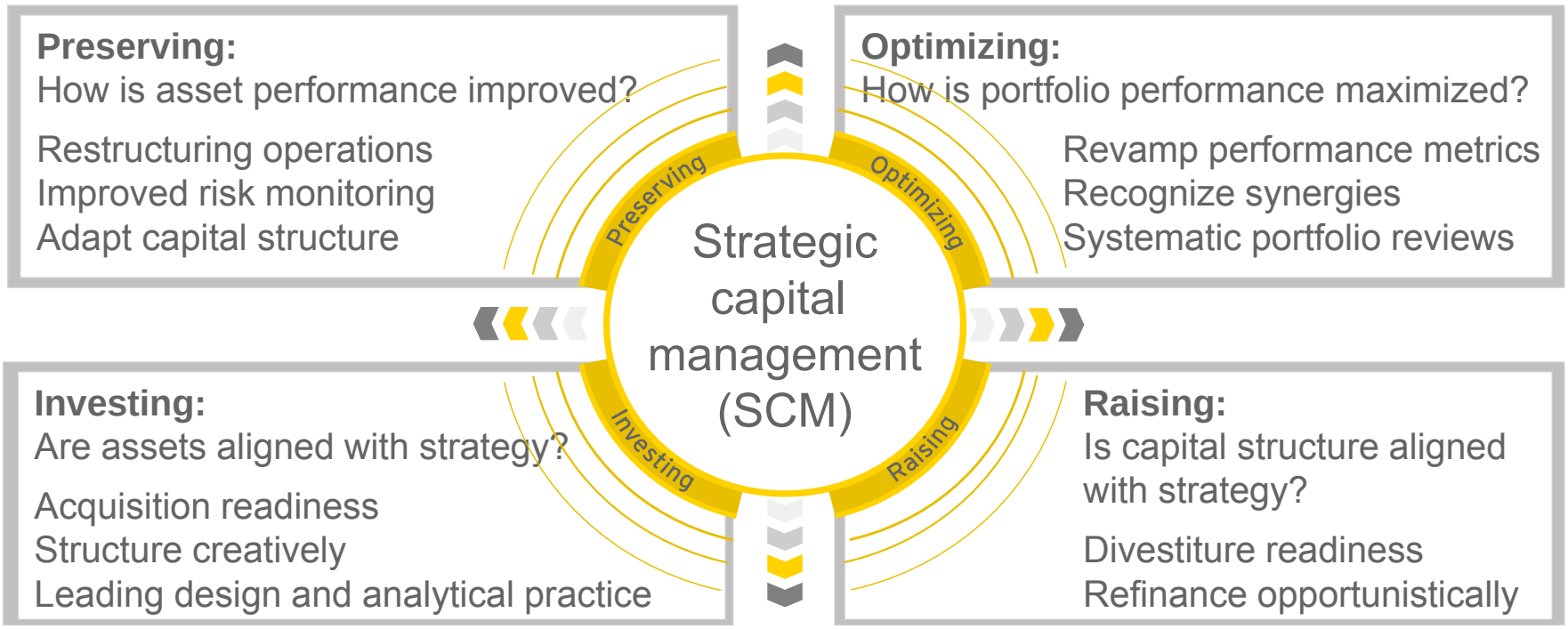
Of all those expensive and uncertain projects, … there is none perhaps more perfectly ruinous than the search after new silver and gold mines."

Adam Smith (1776), The Wealth of Nations, Book IV, Chapter VII, page 610.

- Integrated Valuation and Risk Modelling (IVRM)
- Analysing a stream with IVRM
- Concluding comments
- Appendices – Price models



Strategic capital management (SCM) —
Managing capital in support of business objectives



The challenge for SCM

Making capital management decisions when market / industry / project conditions are uncertain – can dynamic models help balance risk and reward?

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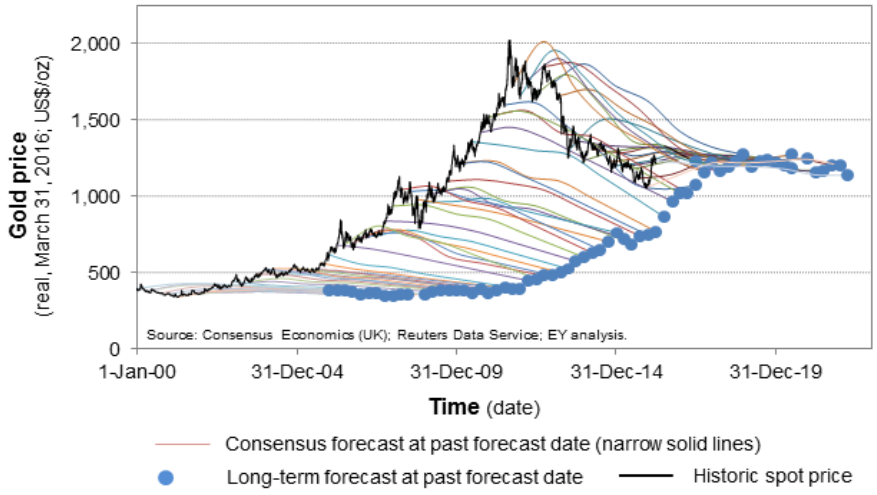
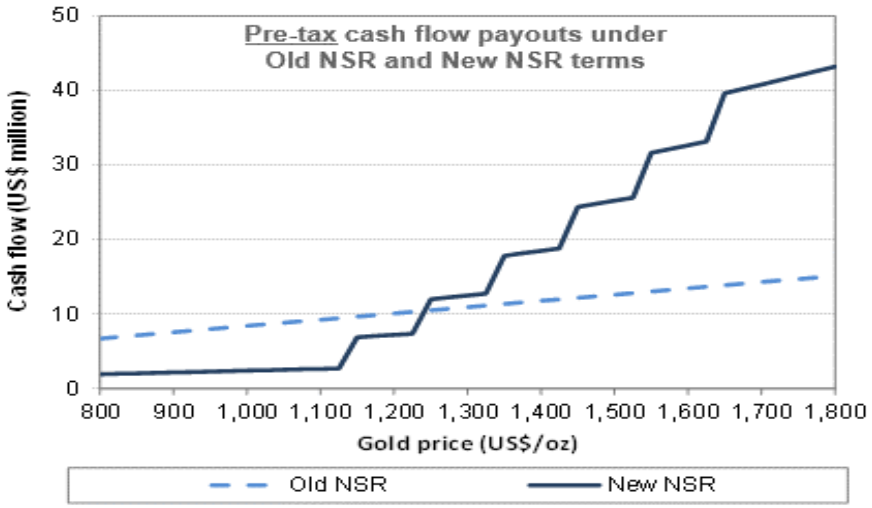
Strategic capital management —
Recognizing forecast uncertainty and the ability to manage it

- SCM analysis is often performed with static forecasts that are updated annually for changes in business outlook.
- Effectively describing uncertainty in price forecasts requires asking:
  - How do spot prices move around a forecast?
  - How are corporate forecasts revised / updated as business conditions change?
- SCM analysis also ignores our ability to manage uncertainty through contingent finance and management flexibility.
- Modelling our ability to manage uncertainty requires thinking about:
  - What are the range of future business outlooks (describing uncertainty)?
  - How do we adapt our project / company to future business conditions?

Updates to long-term gold consensus forecasts

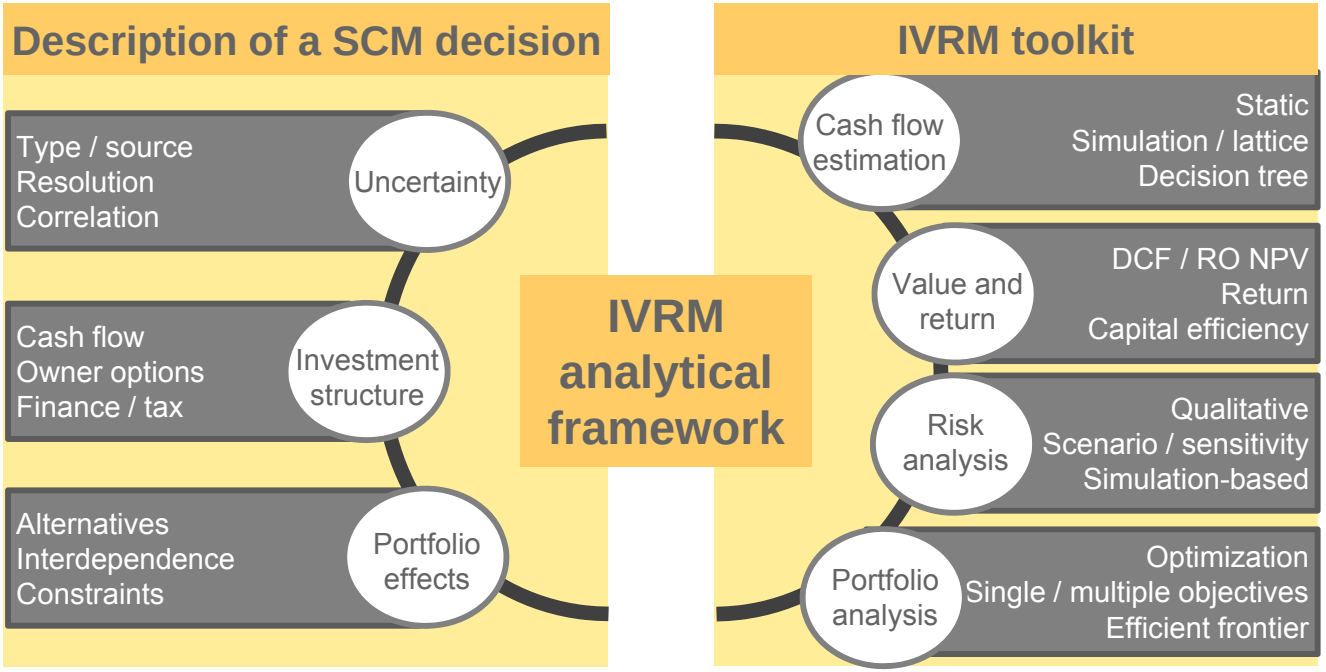


Contingent financing tied to metal price



Integrated valuation and risk modelling —
Making static cash flow models dynamic

- **Integrated Valuation and Risk Modelling** (IVRM) is a framework combining:
  - Finance theory
  - Risk management concepts
  - Numerical methods
  - Decision analytics
  - Statistical analysis
- Performing an IVRM analysis requires a description of the SCM decision and then deciding how to apply the IVRM framework.




Stream analysis with metal price uncertainty

Alternative financing
Current financing environment

- EY analysis suggests raising capital is still difficult for mining companies.
  - Capital raising has declined by 3% in the first 9 months of 2016 versus same period in 2015. Debt finance has declined 21% to US$68 billion.
- However, demonstrating adequate liquidity remains key for mining companies due to commodity price volatility and uncertain long-term fundamentals. Accessing capital to improve liquidity is problematic:
  - Equity issuance is highly dilutive.
  - Debt accessible to only the most stable companies.
  - Divesting assets may be at low prices.
  - Operational and working capital efficiencies may have already be gained.
- Alternative financing methods such as streaming and royalties are being considered by mining companies.
  - Streaming / royalty companies are becoming more selective (eg. late-stage development projects / operating mines in lowest cost quartile) and raising equity (eg. Franco-Nevada raising $920 million in an oversubscribed issuance).

Alternative financing
Streaming versus royalties

- Royalties and streams are similar alternative mine finance methods:
  - A royalty financing is an upfront payment in exchange for a fixed percentage of revenues, profits or value of metal produced.
  - A stream financing is sales agreement where an initial payment in made for a fixed proportion of metal production and a delivery payment set at below market prices.
- Some of the differences between royalties and streams are:

Characteristic	Royalty	Stream
Upfront payment to MineCo	Yes	Yes
Future payments during operation	No	Yes – below market
Deposit area	Specific lease area	Mine output
Exploration upside	Only within specific area	Yes
Time period	Indefinite / license life	Life-of-mine / output level
Buy back / step down	Yes	Yes
Security	May have resource interest	Contractual claim with MineCo
Tax	Deductible when paid	Structured / non-deductible

Example: Stream financing at a gold mine
Background

Issue:

Owners of a developing gold project are considering a stream agreement to improve their financial position. How does the stream impact project viability and risk exposure?

Solution:

Test the stream's impact on the project over a range of gold prices with simulation to obtain unbiased cash flows estimates and an indication of risk exposure.

- A mining company ("MinCo") is developing a new gold project and needs to improve its financial position due to a decline in metal prices. Reducing the remaining project capital requirements is one possibility.
  - The company has rejected raising equity or increasing debt but would consider a streaming deal as it is considered non-dilutive.
- A streaming company ("StreamCo") is has offered staged upfront payments to the project during construction in exchange for the future delivery of gold at 25% of the spot price.
- MinCo's board views the stream proposal as generally favourable but would like more clarity about the risk effects of the stream.

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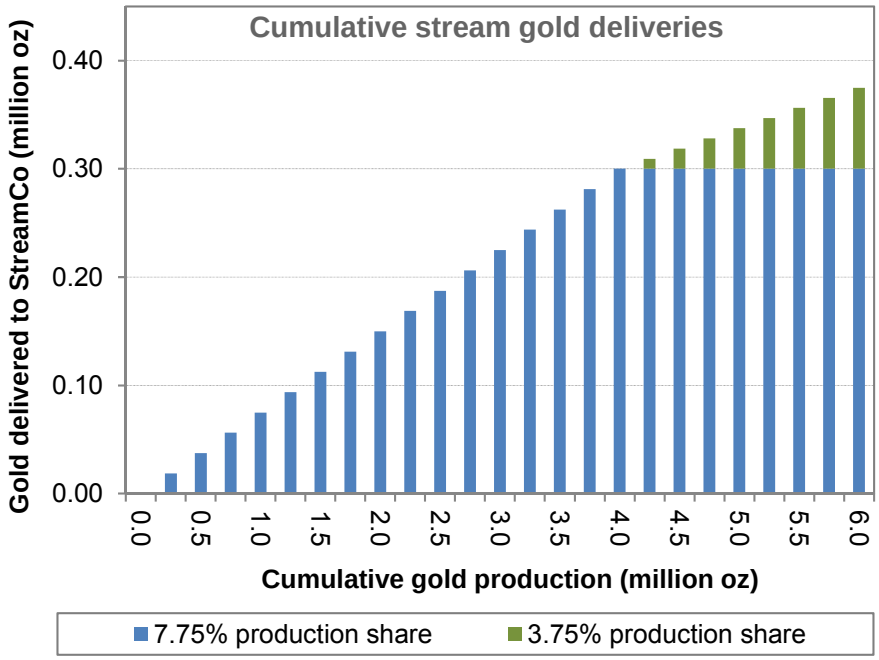
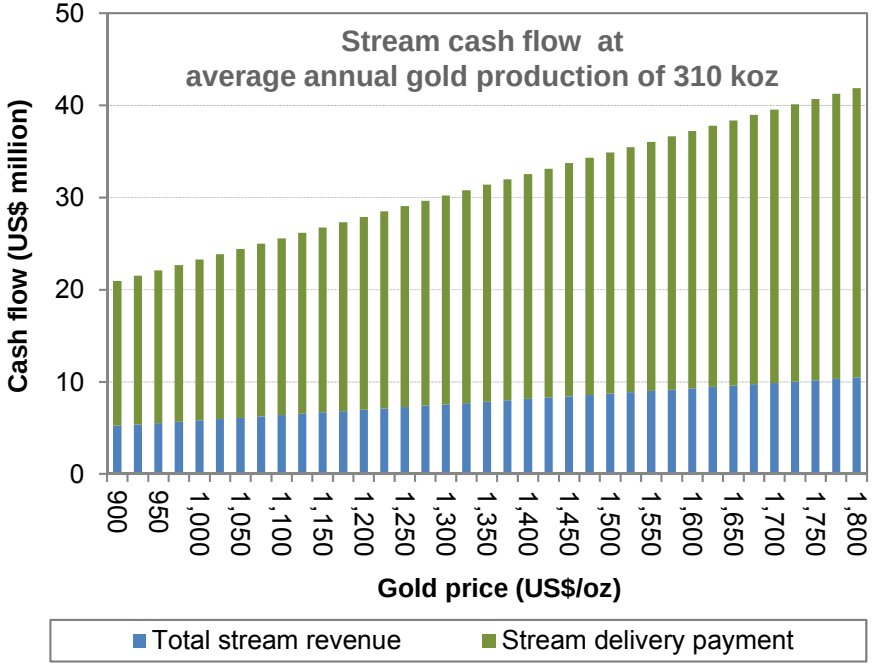
Example: Stream financing at a gold mine
Mine operations and government taxes

- The gold project is planned as a combined open pit / underground operation with a reserve base of 3.9 million ozs. The project has a 14 year operating life of which the last 2 years are processing a low-grade stockpile.
- Annual mill through-put is 7.7 million tonnes with annual payable gold production of 310 thousand ozs ("koz") during operation and 74 koz when processing the stockpile.
  - Average annual mining / milling / G&A / TCRC costs of $578/oz when operating and $870/oz during the last two years of processing.
  - Annual sustaining CAPEX is $103/oz for the first 11 years and $45/oz afterwards.
- Project is one year into a three year build program. Total CAPEX is $887 million ("m") with the balance of $788m incurred over the next two years.
- The government participates in the project through corporate income tax levied at a rate of 25% on both mine and stream taxable income.
  - Development CAPEX is depreciated with a simple 10-year straight line schedule.
  - Stream deliveries during operations are not tax-deductible for MinCo.

Example: Stream financing at a gold mine
Stream terms

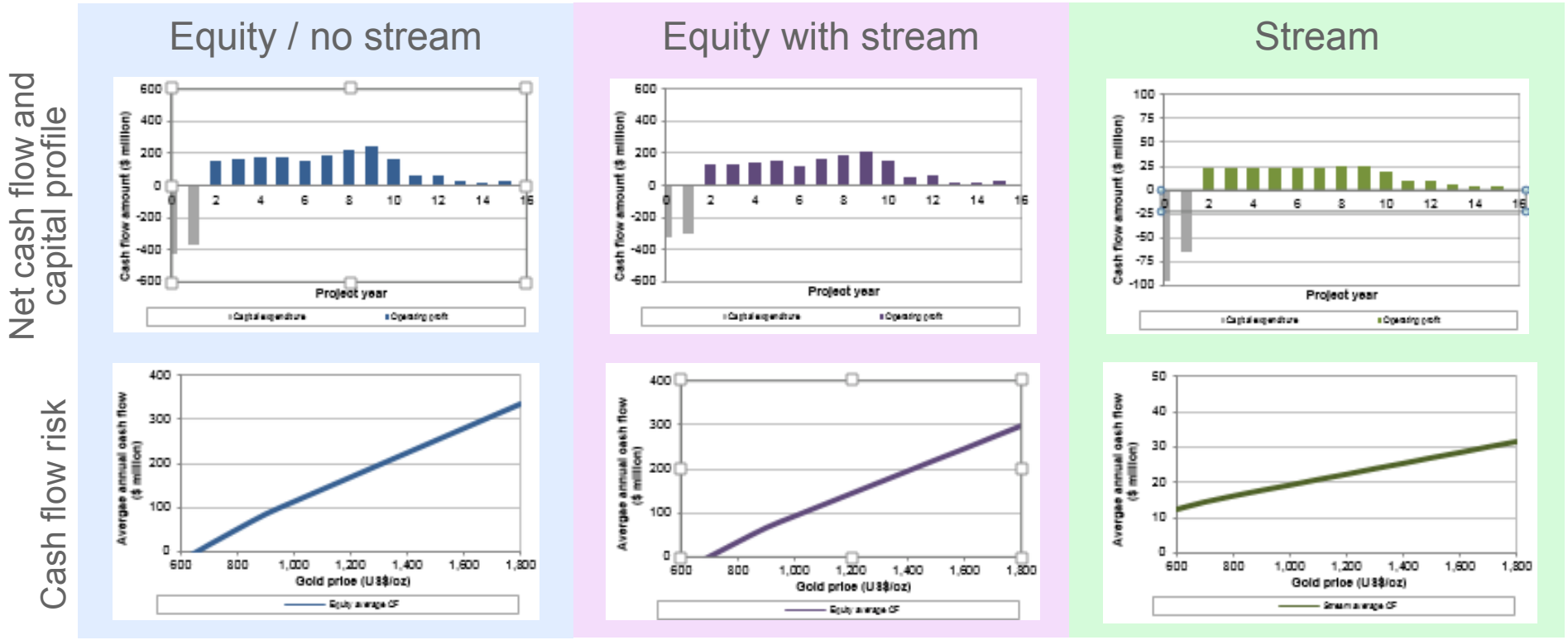
- StreamCo will make upfront payments totaling $160m — $95m in Year 1 and $65m in Year 2.
- During mine operations, StreamCo will pay 25% of the spot gold price for 7.5% of gold production to a maximum gold delivery amount of 300 koz.
  - Thereafter, StreamCo receives 3.75% of gold production at 25% of the gold price.





Example: Stream financing at a gold mine
Cash flow information from a static model

- A limited amount of information is generated by a static cash flow model.
  - Amount and timing of cash flow is provided but cash flow risk is communicated with simple measures linked to sensitivity analysis.

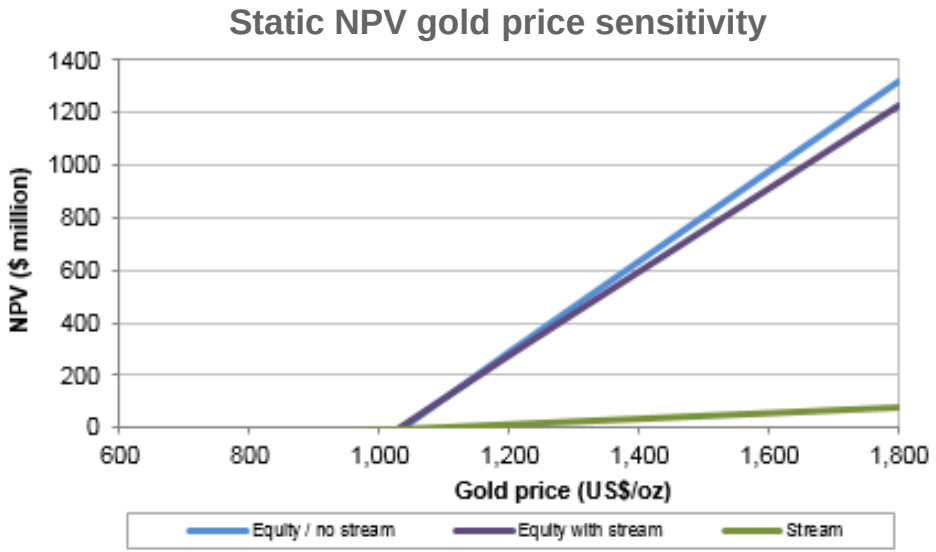


Example: Stream financing at a gold mine

Standard investment analysis with static cash flow

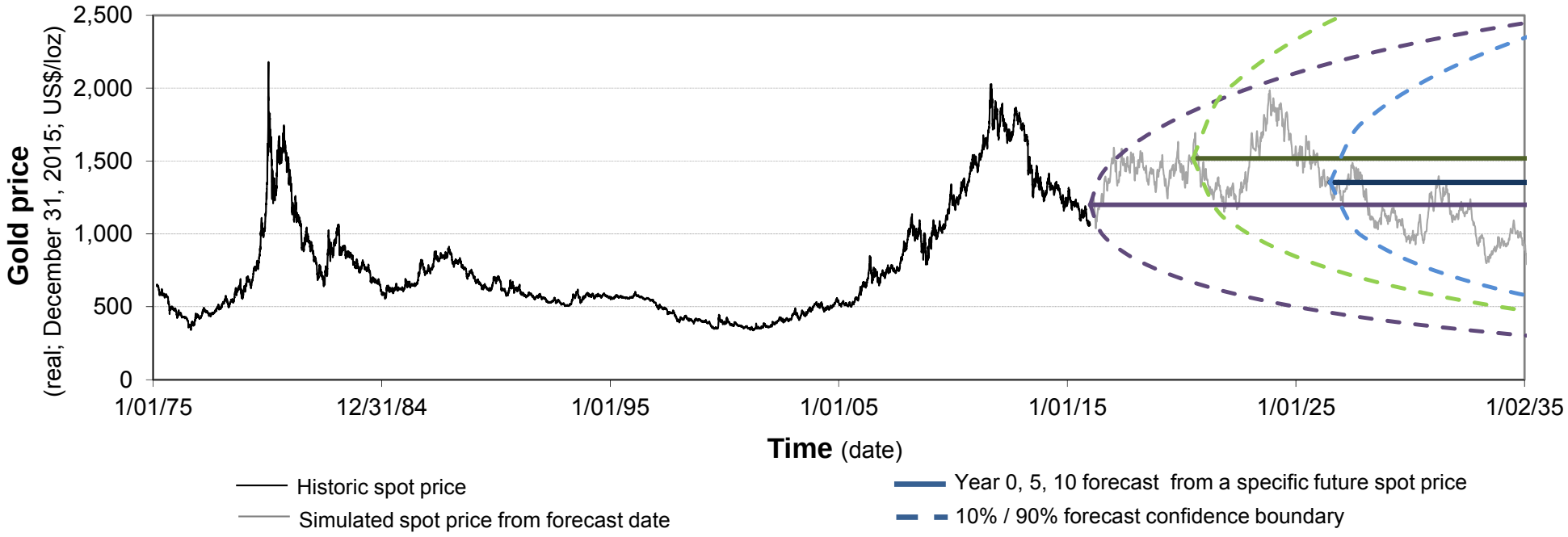
- Equity NPV has a small decline from entering streaming deal while capital efficiency increases by 20%.
  - Equity profitability index (PI) increases from 0.52 to 0.63 from the $160 million upfront payment.
- Equity NPV more sensitive to gold price changes than Stream NPV.
  - Equity and Stream NPVs are negative when gold prices are below $1050/oz.

Stakeholder	Investment benefit	
	NPV ($ million)	**Profitability index (PI)**
Equity / no stream (DR=7%)	**372**	0.52
Equity with stream (DR=7%)	356	**0.63**
Stream (DR=5%)	**18**	**0.12**



Example: Stream financing at a gold mine
Introducing gold price uncertainty

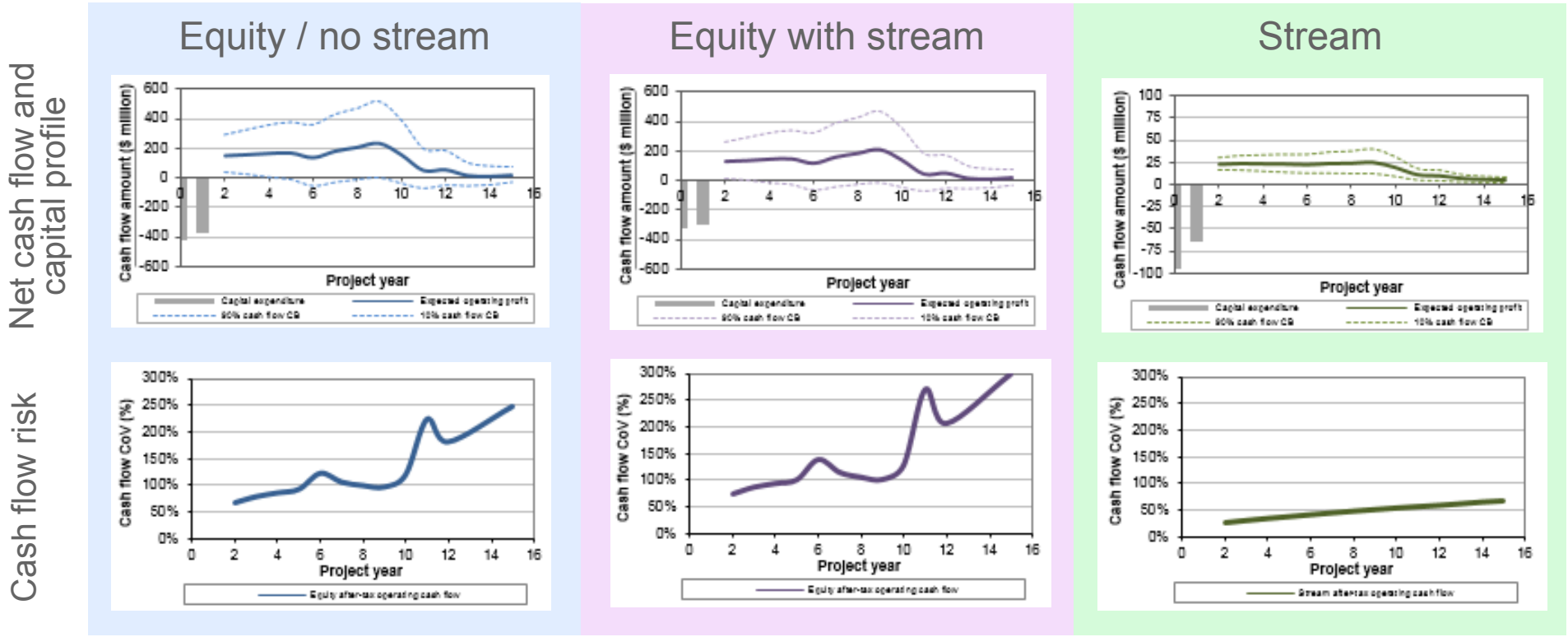
- Gold price uncertainty is modelled with a non-reverting distribution with an initial long-term forecast of $1,250/oz.
- Key features include:
  - Long-term forecasts move in lockstep with spot price movements. A 2% rise in the spot price results in a 2% increase in the long-term forecast price.
  - Uncertainty increases with term (time from today).



Example: Stream financing at a gold mine

Cash flow information from dynamic model with no early closure

- The introduction of a gold price uncertainty model and simulation provides a greater range of cash flow information.
  - Cash flow amounts are supplemented with a range of risk information such as cash flow variability and the level of uncertainty.

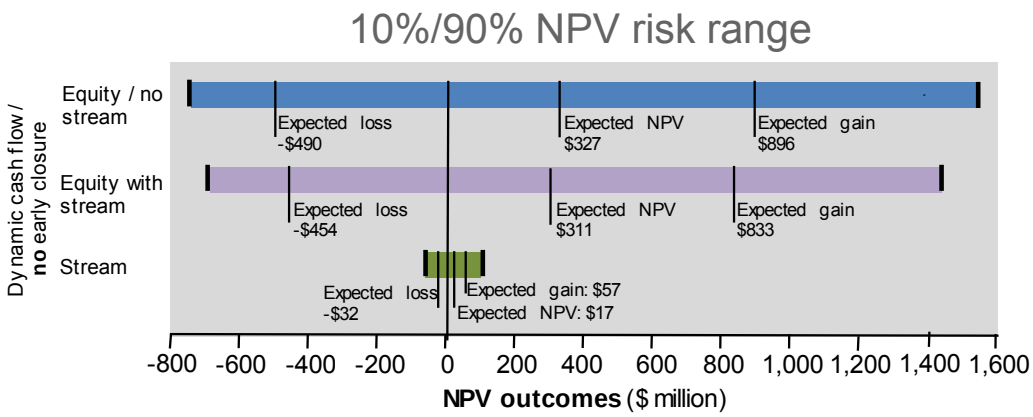


Example: Stream financing at a gold mine

Investment benefits and risk exposure (no early closure)

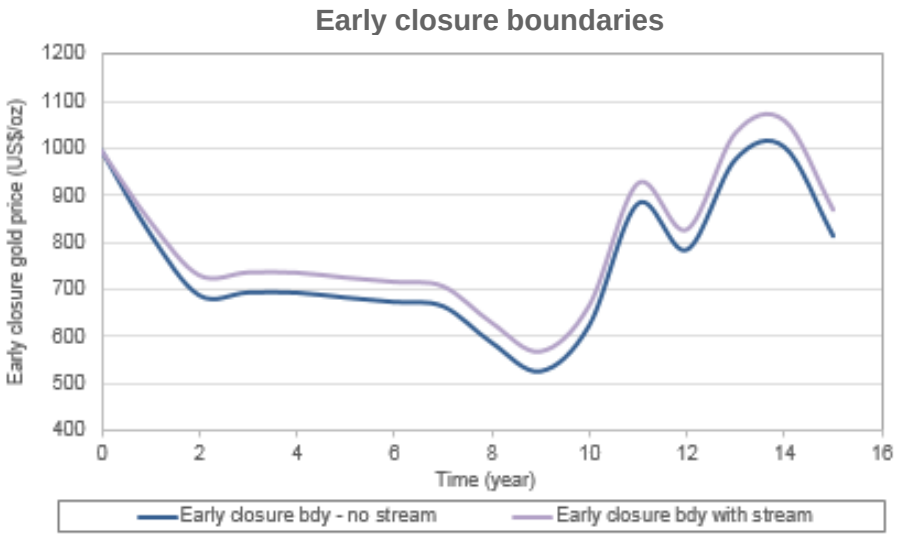
- Modelling gold price uncertainty reveals a small tax non-linearity.
  - Dynamic Equity NPVs are 12% lower than static NPVs. Dynamic PIs are also 10% lower.
  - Stream NPV less affected by tax.
- Risk information from simulation suggests the Stream absorbs risk from Equity.
  - Lower 10% NPV confidence boundary moves from –$733m to –$676m. Equity NPV conditional loss declines from –$490m to –$454m.
  - Stream also reduces some of the benefits of higher gold price environments for Equity.

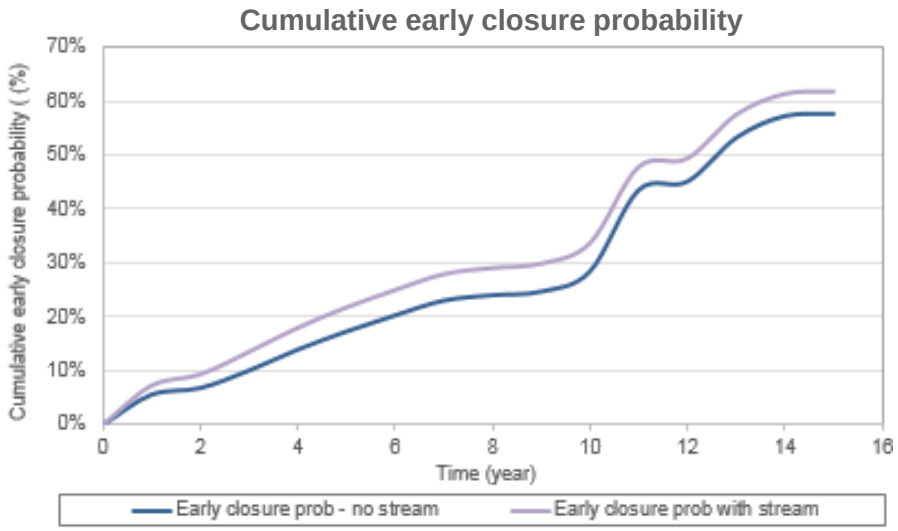
	Investment benefit		PI risk exposure	
	NPV			
Stakeholder	($ million)	**PI**	**PI loss**	**PI Gain**
Static cash flow				
Equity / no stream (DR=7%)	372	0.52		
Equity with stream (DR=7%)	356	0.63		
Stream / no close (DR=5%)	18	0.12		
Dynamic cash flow (no early closure)				
Equity / no stream (DR=7%)	327	0.46	-0.69	1.26
Equity with stream (DR=7%)	312	0.55	-0.80	1.47
Stream / no close (DR=5%)	17	0.11	-0.22	0.38



Example: Stream financing at a gold mine
Early closure flexibility

- Early closure flexibility limits cash flow losses due to low gold prices.
  - Early closure price set to All-In-Sustaining-Cost ("ASIC") during production.
  - Closure price increases after Yr 11 due to low grades / stockpile ops.
  - Cumulative probability of early close is 29% to Yr 10 and 58% for Life-of-Mine ("LOM").
- Stream financing increases chance of early closure.
  - The early closure price increases on average by $45/oz.
  - Cumulative probability of early close increases to 34% by Yr 10.

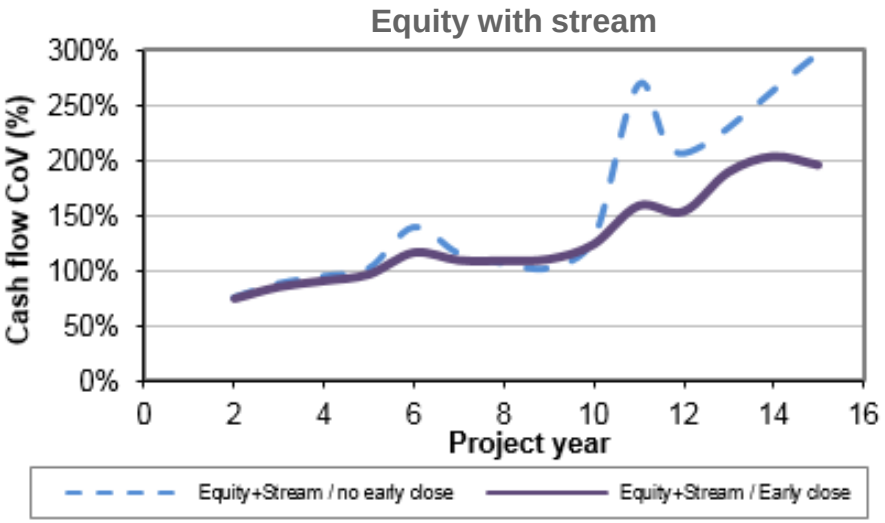


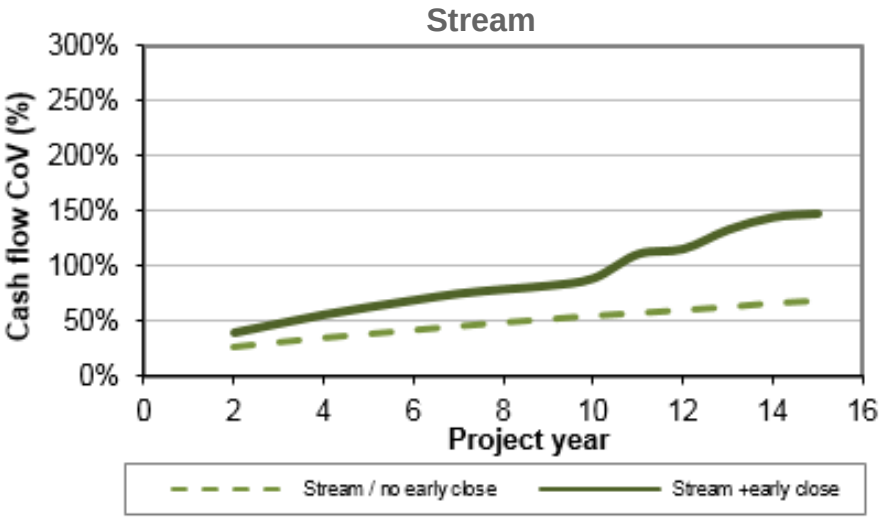


Example: Stream financing at a gold mine

Impact of early closure flexibility on cash flow uncertainty

- Early closure has minimal impact on Equity cash flow uncertainty to Year 10 and then generates a greater reduction of uncertainty during later years.
  - Average annual cash flow CoV for the first 10 years is 106% with no close and 102% with early closure.
- Stream cash flows become more uncertain when early closure is recognized.
  - Average annual cash flow CoV increases from 49% to 90% after recognizing early closure.



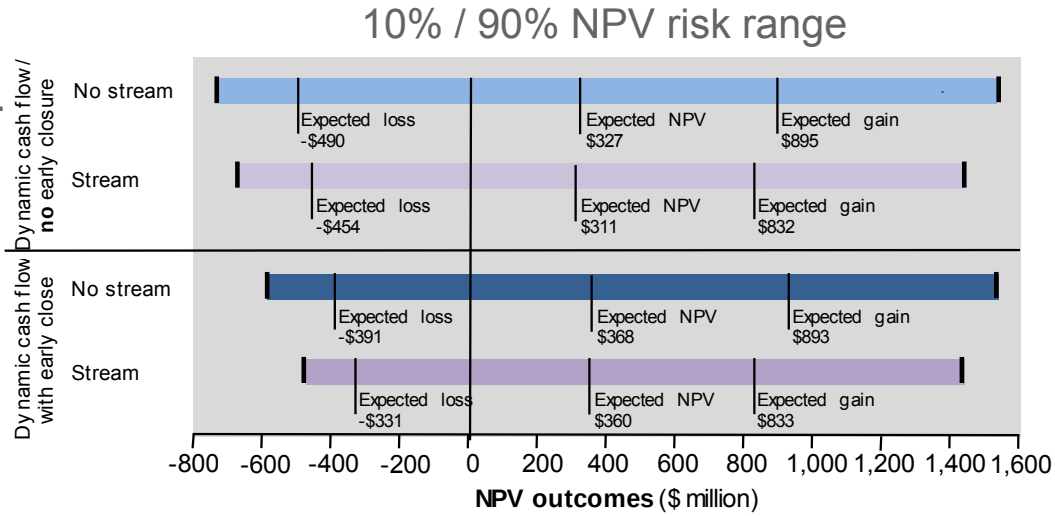


Example: Stream financing at a gold mine

Equity investment benefits and risk levels of early closure

- Equity NPV increases by about 12% after recognizing the effects of early closure. Capital efficiency also improves.
- The combined influence of early closure and streaming reduces risk exposure to low gold price environments.
  - NPV 10% confidence boundary improves from –$733m to –$479m.
  - Expected NPV loss improves from –$490m to –$331m.
- Streaming reduces Equity upside through lower expected NPV gain.

Stakeholder	Investment benefit: NPV ($ million)	Investment benefit: PI	PI risk exposure: PI loss	PI risk exposure: PI Gain
Dynamic cash flow (no early closure)				
Equity / no stream (DR=7%)	327	0.46	-0.69	1.26
Equity with stream (DR=7%)	312	0.55	-0.80	1.47
Dynamic cash flow with early closure				
Equity / no stream (DR=7%)	369	0.49	-0.61	1.26
Equity with stream (DR=7%)	361	0.60	-0.67	1.47

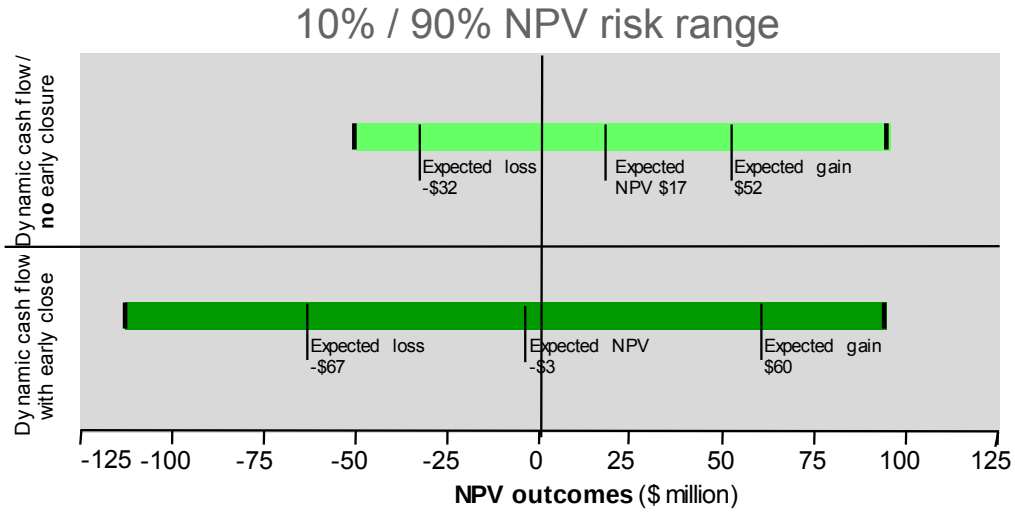


Example: Stream financing at a gold mine

Stream investment benefits and risk levels of early closure

- Stream NPV becomes negative after recognizing the possibility of early closure. PI also becomes negative.
- The NPV risk range expands with early closure.
  - Risk exposure to lower gold price environments is greater. 10% NPV confidence boundary declines from -$50m to -$113m. Expected loss declines from -$32m to -$67m.

	Investment benefit		PI risk exposure	
Stakeholder	NPV ($ million)	PI	PI loss	PI Gain
Dynamic cash flow				
Stream / no close (DR=5%)	17	0.11	-0.22	0.38
Stream with close (DR=5%)	-3	-0.05	-0.51	0.40



Example: Stream financing at a gold mine
Concluding thoughts

- This case study highlights that the benefits and costs of stream financing are more nuanced than a conventional static cash flow analysis would indicate. Recognizing metal price uncertainty and flexibility in cash flow modelling provides additional valuable insights.
  - The ability to manage low metal prices through early closure is a benefit to MinCo through an increase in NPV and PI while also reducing risk. Entering a stream agreement may also further moderate risk through reducing upfront CAPEX for a small decline in NPV.
  - Early closure flexibility is an issue for StreamCo. Flexible simulation indicates that the current terms generate a negative NPV and PI for the stream while also creating a risk exposure that is unrecognized by static models.
- There are a couple of future extensions to this case study:
  1) Exploration upside: The possibility of discovering additional resources that extends the Life-Of-Mine beyond its current 14 years.
  2) Revenue support program: Reduce the risk of early closure from low gold prices through financial contracts (eg. costless collars, forward put options). A small support program may have large risk management benefits.

Appendix 1: Modelling metal price uncertainty with IVRM

Modelling commodity price uncertainty —
The importance of long-range forecasts

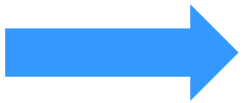
- Long-term metal price forecasts are the key input into the analysis supporting natural resource SCM decisions.
  - Forecasts influence corporate strategy, project design, financing, taxation, community relations and government policy among other things.
  - Price forecasts are generated with a range of techniques incorporating insights and information from industry (supply information), the economy (demand information), and financial markets (pricing information).
- Unfortunately, we often forget that long-range forecasts are dynamic as they are a summary view of an extremely large number of future possibilities that change over time.

Modelling commodity price uncertainty —
Scenario analysis and long-range forecasts

- The natural resource industries often recognize long-range forecast uncertainty with scenario analysis (price decks).
  - Long-range forecast scenarios are sometimes probability weighted to provide additional information about price variability. This approach to uncertainty modelling ignores long-term forecast updating.

Price deck	
Scenario	Au price
Blue sky	$1,500
Higher	$1,400
High	$1,300
Forecast	**$1,200**
Low	$1,100
Lower	$1,000
Lights out	$ 900

Price variability may be recognized by assigning probability weights to each scenario



Price deck		
Scenario	Au price	Probability
Blue sky	$1,500	5%
Higher	$1,400	10%
High	$1,300	20%
Forecast	**$1,200**	**30%**
Low	$1,100	20%
Lower	$1,000	10%
Lights out	$ 900	5%
Expected price		**$1,200**

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Modelling commodity price uncertainty —
Three components of an uncertainty model

- Unfortunately the price decks and their associated probability-weights are an incomplete model of price uncertainty – we still need to recognize forecast updating over time.

Three features of a complete model of price uncertainty

Price variability describing uncertainty around a forecast

- The model we use generates a lognormal price distribution at each future time point.

Forecast updating allowing for dynamic expectations

- Future expectations change as prices change.

Forecasts generated by:

- Supply / demand projections.
- Cost curve models.
- Consensus forecasts.
- Financial market information.

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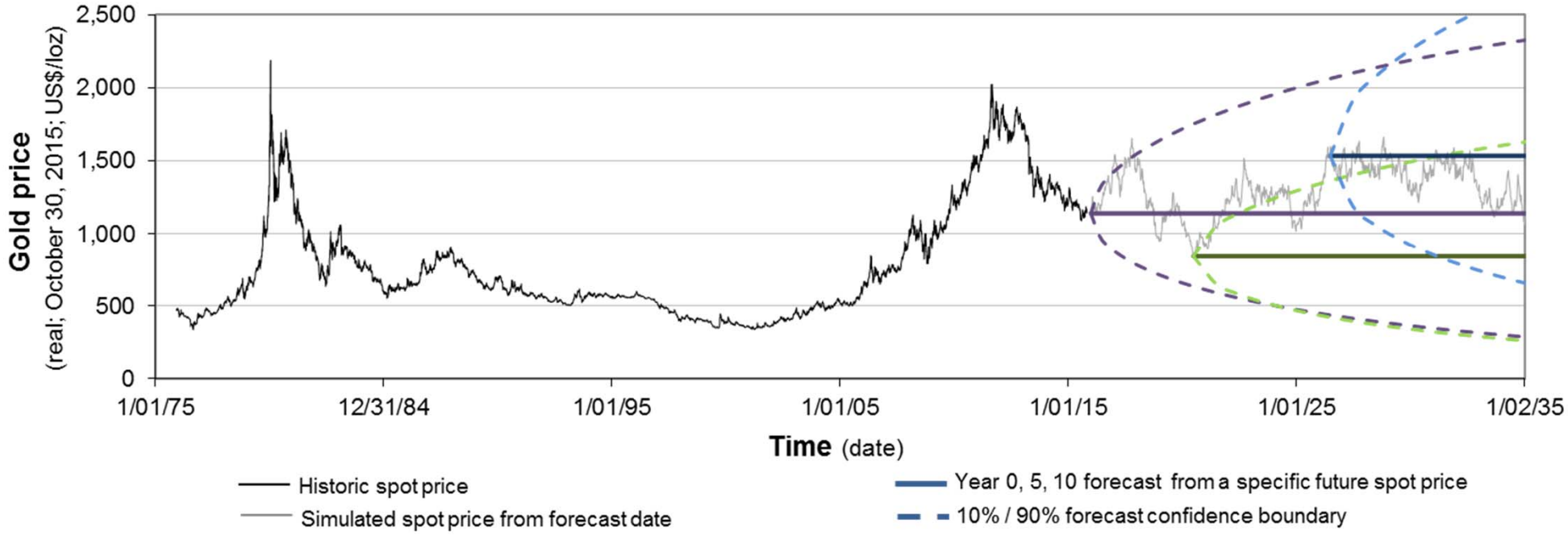
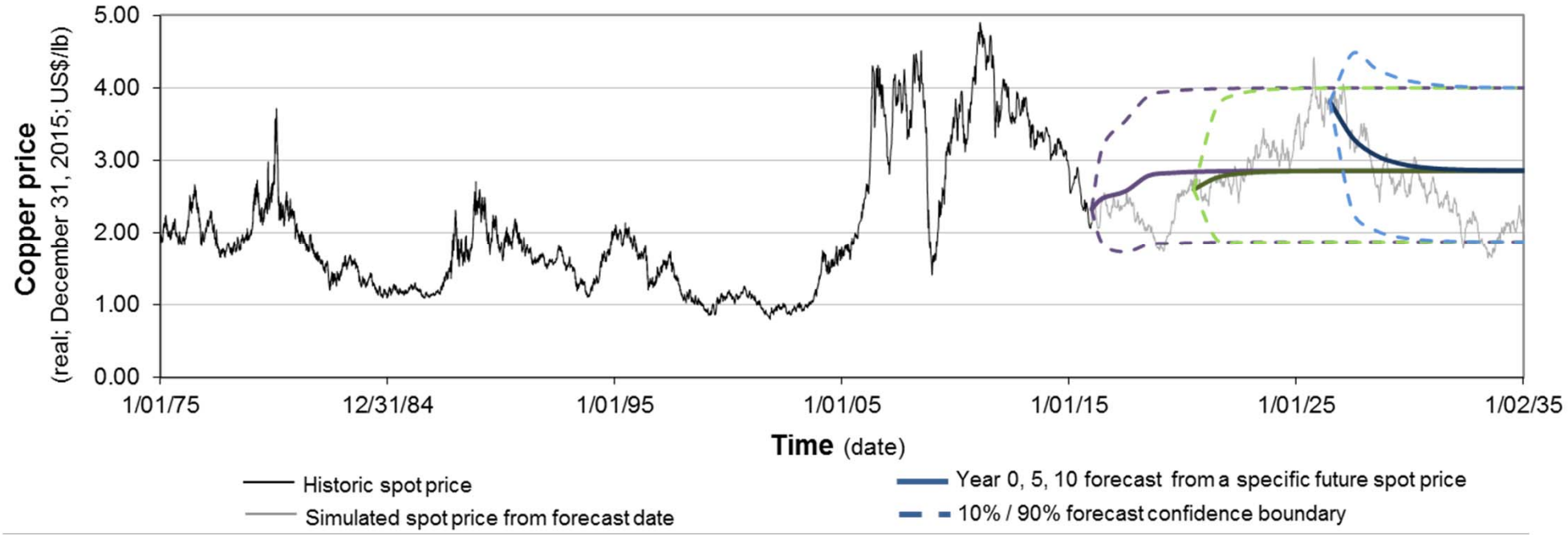
Modelling commodity price uncertainty —
Single factor non-reverting models

- Non-reverting models are used to describe the price movements of financial stocks, precious metals, FX and possibly a few base and minor metals.
- Key features include:
  - Long-term forecasts move in lockstep with spot price movements. A 2% rise in the spot price results in a 2% increase in the long-term forecast price.
  - Uncertainty increases with term (time from today).



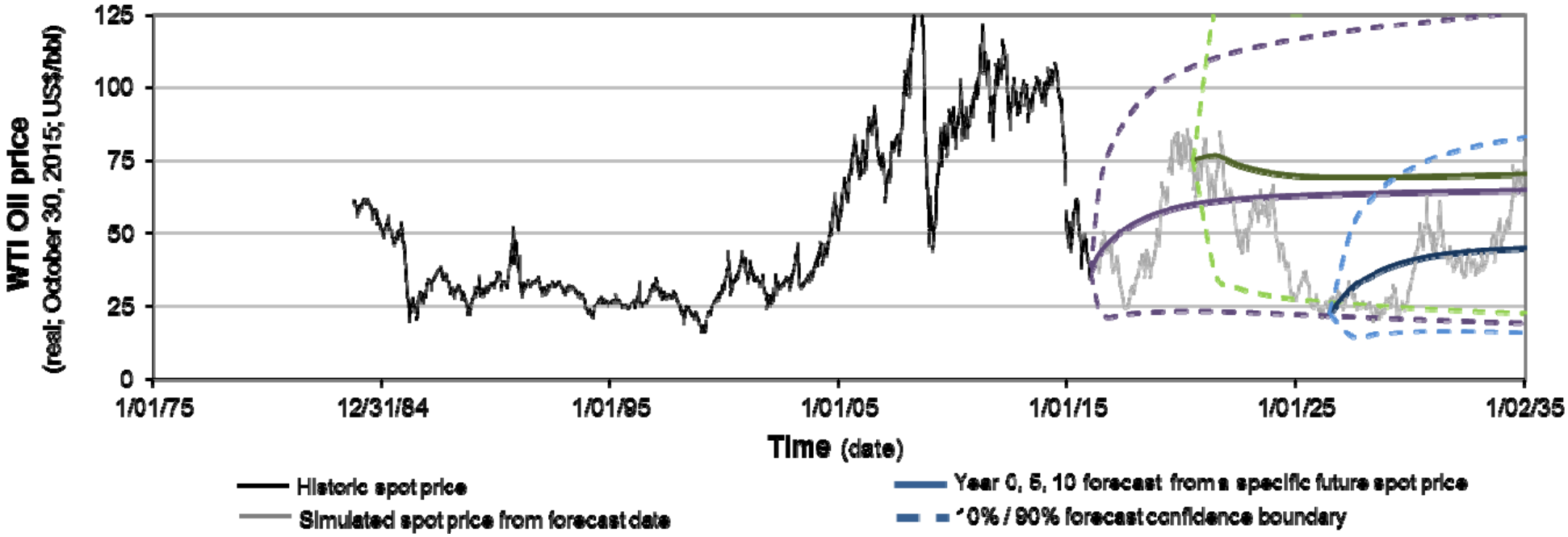
Modelling commodity price uncertainty —
Single factor reverting models

- Reverting models describe base metal and energy price movements.
- Key features include:
  - A constant long-term forecast. Spot price vary around the long-term forecast price.
  - Uncertainty saturates with term which can impact the cash flow discounting of long-life projects.
  - Need to update the long-term forecast for market regime changes.



Modelling commodity price uncertainty —
Two-factor reverting models

- Two-factor reverting models provide an improved description of base metal and energy price movements.
- Key features include:
  - Both spot price and long-term forecast price are uncertain.
  - Uncertainty saturates slowly with term. Variability in the long-term forecast can generate option value for large base metal and energy projects.



Appendix: EY professional biographies

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Dr. Michael Samis, P.Eng. is a leading Integrated Valuation and Risk Modelling practitioner in the natural resource industries with more than 25 years of mining experience. He has extensive professional experience valuing base and precious metals, diamond, and petroleum projects with complex forms of flexibility and risk. His assignments have ranged from exploration stage to late-stage capital investments and have also included the analysis of project financing and contingent taxes. Mike has presented more than 30 professional courses on advanced valuation at universities, natural resource companies, and professional organizations world-wide and has published or presented numerous valuation papers about flexible pushback development, multi-stage exploration programs, windfall taxes, and the economic impact of project finance and hedging. Dr Samis is a registered Professional Engineer in Ontario, Canada, and a qualified person for project valuation under NI43-101 guidelines. In 2013, the Canadian Institute of Mining and Metallurgy awarded Mike with the Robert Elver Award for his contributions to the Canadian mining industry in the field of mineral economics. He holds a Ph.D. from the University of British Columbia that combines the fields of mining engineering and finance.

Dr Samis is currently an Associate Partner (Valuation and Business Modelling) in the Toronto office of Ernst and Young's Transaction Advisory Service where he and his team also value complex financial securities such as employee stock options, convertible debt with embedded derivatives, contingent contracts, and interest rate, commodity, and foreign exchange derivatives.

Professional background and qualifications:

University of British Columbia, Ph.D. in Mining Engineering and Finance
University of the Witwatersrand, MSc. In Mineral Economics
University of British Columbia, BSc. in Mining Engineering
Professional engineer registered in Ontario, Canada
Qualified person for project evaluation under NI43-101 guidelines
Member of the 2012 Review Committee for CIM Val Guidelines
Presented with the 2013 Robert Elver Award by the Canadian Institute of Mining and Metallurgy

Appendix:
EY experience with IVRM

Select Canadian mining IVRM engagements

Our Valuation and Business Modelling team has extensive experience assisting mining companies with a wide range of Integrated Valuation and Risk Modelling engagements

Client	Services Performed	Description of Transaction
Global mining company	Financial reporting valuation	Provided a fair value analysis of two African copper assets as part of an acquisition Purchase Price Allocation using Dynamic DCF / Real Option valuation.
Global mining company	Financial reporting valuation	Built a Dynamic DCF / Real Option project template for a global mining company to test for impairment at their long-life South American copper assets.
Global mining company	Financial reporting valuation	Provided a Dynamic DCF / Real Option fair value estimate of a gold project for a Purchase Price Allocation during an acquisition. Analysis minimized goodwill.
Mid-tier mining company	Financial reporting valuation	Provided a Dynamic DCF / Real Option fair value analysis of a gold project and copper-gold project as part of a IFRS deconsolidation exercise.
Global mining company	Financial reporting valuation	Valuation of a copper-gold project using Real Options and Dynamic DCF to support an impairment accounting test. Ensured consistency between the client's in-house DCF and real option models assumptions.
Junior mining company	Project finance	Analysed the value and risk impact of a streaming deal at a base metal project. Analysis showed how the streaming deal reallocated project value between equity, government and the streaming company. Analysis also highlighted streamlining increased the probability of operating losses and generated higher equity cash flow uncertainty.
Mid-tier mining company	Project finance	Provided a derivative-based fair value analysis of the sale of several marginal gold mines where the purchaser earn-in payments where contingent on future gold price with through direct gold price targets or indirectly through cumulative mine free cash flow levels.
Mid-tier mining company	Project finance	Provided a derivative-based review model of gold-linked financing arrangement used by a junior mining company to finance project working capital.
Global mining company	Project finance	Provided uncertainty and risk analysis for a multiple debt financing of a long-life base metal mine in support of a tax review. Demonstrated that the risk profiles of senior debt and subordinated debt with equity participation terms were consistent with returns through the use of stochastic Monte Carlo simulation.

Select Canadian mining IVRM engagements

Our Valuation and Business Modelling team has extensive experience assisting mining companies with a wide range of Integrated Valuation and Risk Modelling engagements

Client	Type of Services	Description of Services
Mid-tier mining company	Mining taxation analysis	Compared mining tax regimes in South America with Dynamic DCF to demonstrate how a proposed tax change increased equity cash flow and NPV risk at low and high cost mines as a means of highlighting the negative consequences of the tax change.
Mid-tier mining company	Mining taxation analysis	Completed an analysis of how a mining tax change impacts the value of a European mining project using Dynamic DCF. Simulation highlighted that mining tax change substantially increased the possibility of negative project NPVs in addition to the expected negative value impact.
Nova Gold	Public report excerpt (NI43-101)	Evaluated the Galore Creek Project on behalf of Nova Gold using Dynamic DCF / Real Options for an NI43-101 report published during September 2011.
Entre Gold	Public report excerpt (NI43-101)	Developed a Real Option and Dynamic DCF model for the Entrée Gold interests in particular sections of the Oyu Tolgoi Project. The model focused on accounting for the cash flow effects and risk management benefits of a non-recourse structured capital development loan when there is copper, gold, and molybdenum price uncertainty. The analysis was summarized in a NI43-101 report in June 2010.
Ivanhoe Mines	Public report excerpt (NI43-101)	Built a Dynamic DCF and Real Option model for the Oyu Tolgoi Project to provide insight into the uncertainty and risk of long-term cash flows and to demonstrate the value of these cash flows. This work was published in a May 2010 NI43-101 report.
Global mining company	Corporate investment decisions	Analysed a proposed multi-billion dollar acquisition of a global energy company by a Canadian mining company using Integrated Valuation and Risk Modelling methods. Analysis demonstrated that the acquisition could decrease post-transaction corporate cash flow and dividend uncertainty even though there were significant FX and metal price exposures. However, analysis of proposed financing structure showed that there was significant probability of a credit rating downgrade.
World-class base metal mine	Corporate investment decisions	Assisted an operating South American base metal mine introduce Integrated Valuation and Risk Modelling methods into their long-range mine planning process. Work included training corporate analysts, providing spreadsheet cash flow modeling tools, and completing a strategic development case study involving capacity decisions, resource expansion, and the switch from surface to underground mining.

Select Canadian mining IVRM engagements

Our Valuation and Business Modelling team has extensive experience assisting mining companies with a wide range of Integrated Valuation and Risk Modelling engagements

Client	Type of Services	Description of Services
Global mining company	Corporate investment decisions	Prepared a strategic review of the development alternatives for a large copper-gold project involving capacity choice, contingent capital investment, and deposit development timing that combine Dynamic DCF / Real Option methods with proprietary flexible Monte Carlo numerical method.
Mid-tier mining company	Corporate investment decisions	Developed Dynamic DCF and Real Option models for three competing designs of a long-life base metal mine. A report was provided to a deal room commenting on the value of long-term cash flows and the relative risk characteristics of each design.
Global mining company	Corporate investment decisions	Participated in an internal investigation of a large global mining company into the potential of Dynamic DCF and Real Option evaluation methods for capital budgeting and investment decisions-making. Prepared two evaluation case studies based on long-life copper mines. Presented two workshops that provided an overview of using Real Option and Dynamic DCF methods in the mining industry to the project team and the business development department.
Global power company	Corporate investment decisions	Provided a Real Option model to assess the relative uncertainty and risk characteristics of nuclear, coal-fired, and natural gas-fired power plants and how this affects financing risk of each plant type. Analysis showed that overall generation costs of a nuclear power plant compare favorably to other power plants. This analysis is being used to refute the conclusions of industry showing that nuclear plants have higher generation costs.
Mid-tier mining company	Corporate investment decisions	Developed a simulation tool to assist with setting reserve and resource prices in mine planning exercises using a risk management approach for a gold mining company. Uncertainty sources included gold price, energy price, and foreign exchange rates.

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